Building the House

tells you

How to Build It

A Pocket Guide

for the

HOME-BUILDER

ONE DOLLAR

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How to Build It

A Manual of Construction

FROM

KEITH'S ARCHITECTURAL SERVICE

MINNEAPOLIS :: MINNESOTA

ENABLING THE HOMEBUILDER TO SUPERVISE THE CONSTRUCTION OF HIS HOME AND TO REMEDY AS WELL AS RECOGNIZE FAULTY WORK. SHOWING THE CONTRACTOR LATEST IMPROVED METHODS OF CONSTRUCTION.

PRICE ONE DOLLAR

"Send me now therefore a man cunning to work in iron, in stone and in timber."—II Chron.

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PREFACE

IT IS the purpose of this book to furnish a plain, practical guide and helper to one who, from necessity or choice, superintends the building of his own home, and to the many contractors who are engaged in the business of building homes.

The technicalities of mason and carpenter work, the proper installation of a heating apparatus, methods of lighting, interior finish, etc., details too puzzling to the novice, are here treated in a plain and practical manner, so that the intelligent layman will have no difficulty in comprehending them, as simple terms are used thruout. Technical terms when used, are explained. Drawings have been freely employed to more clearly illustrate the matters treated.

While the best methods are shown and recommended, the need for economy has been considered and where possible to attain fairly good results by cheaper construction, it has been suggested.

Plans and specifications are not included in this book as working drawings from a thoroly competent architect, are indispensable to satisfactory results in the building of any home, be it cottage or mansion. It will show you how to recognize work properly performed, calls attention to inferior and faulty methods of construction and gives warning of the various ways in which work is often slighted.

The problem which confronts the home builder is that of the most artistic design, the most practical and complete arrangement, and the most attractive interior for the minimum expenditure of money. This pocket guide designed to help solve that problem, and as a supplement to good working drawings, will go far to insure a successful outcome.

It is hoped that this book will prove of great benefit to many home builders thruout the country, as it embodies the results of the large experience of several experts who have interested themselves in determining the best and most economical methods of construction, and who have kindly assisted in the preparation of this work.

MASON WORK

Locating the Building.

WHEN locating the house or building upon the lot, it is usually a good plan to establish the finish grade of the house somewhat above the grade of the lot, so as to provide slope away from the house in every direction. The black loam that comes from the excavation should be carefully scraped to one side and preserved for top soil upon the completion of the building.

Excavation.

In digging a cellar in sandy soil, the ground must be sloped back quite a little to prevent caving, and under no circumstances should the earth be filled in against the wall until the wall is thoroughly dry. Should the soil be clay it would be a good idea to fill in with sand around the outside; for if wet clay should freeze, it would heave and be liable to crack the wall.

Half Cellars.

There is very little saving by excavating only a portion of the basement, and building cross walls. If a round brick cellar only is put in, the saving is quite a little; but if a square cellar is made, the saving is very small, as the walls put in would go a long way toward carrying down the walls the full depth around the entire house.

Bank Cellars.

In laying a foundation practically on the surface of the ground and sloping the cemented wall toward it, the slope of the wall should not be less than 35 de-

grees, and the top of the wall should not be within eighteen inches of the foundation, and more if soil is such as will cave in easily. This method would effect a saving of not more than one-third in the cost of a foundation, as it is necessary to plaster with cement the ground on slope and ledge. As between the two methods, the little additional expense required to carry the wall down full depth, is money exceedingly well invested.

Soil.

If there have been no previous excavations in the locality to determine the general character of the soil, it can be investigated by boring at short intervals about the site, with a 2-inch auger. Samples will be thus obtained upon which to base an opinion.

Water is often encountered where the land is a flat between high hills. Even though surface indications are perfectly dry, investigation reveals an underground lake, requiring piles to make it at all suitable for building purposes.

Soils are classed as rock, ordinary soil, and made ground. Foundations are of relative value in the order named, level bed rock, sand and gravel, and clay for moderate loads, if kept dry. If quicksand is encountered it can sometimes be removed. Soft, mushy ground may be piled or the footings of the wall spread enough to reduce the pressure to the safe load.

Made ground, usually composed of ashes, garbage and general refuse will carry small buildings without difficulty if care has been taken in its preparation and it has had time to thoroughly settle. For more important work its bearing power should be tested.

Basements built upon sand, gravel or chalk subsoil are not likely to be troubled with water unless the lot is situated in a basin. Sand overlying clay, in a damp soil, will be unstable if the water is drained away later. The presence of a body of clay in a soil

composed chiefly of gravel may divert water to a wall built in a location usually dry. Clay is affected by atmospheric conditions and foundations built in it or other damp soils should be started well below the frost line. Four feet is a minimum depth for a foundation below grade. Sand makes an excellent foundation if it is confined laterally and not influenced by running water.

Drainage.

A wet soil should be drained about the foundation at the time it is built to avoid trouble later on. There are various ways of preventing dampness in cellars, the best being those which keep it out of the walls from the outside, rather than those that take care of it after it has entered. A good way is to place an open jointed tile down, on a level with the footings, all around the house to drain into the sewer, a constructed pool, or other convenient outlet.

Footings.

Having ascertained the condition and composition of the soil with a view to the best materials to employ and the general requirements of the situation, consideration may be given to more exact dimensions and details. Attention is called to Figure 1. Note first of all the footing of cement shown 8 inches thick with a projection of 6 inches beyond the width of the wall on each side. A footing should always project less than its thickness and if the bearing power of the soil is weak, requiring a greater spread, two or even more footings should be formed, each of a thickness and proportion that will conform to the above rule.

Footings should be poured between planks staked to hold them in position and composed of 1 part Portland cement, 3 parts sand and 5 parts gravel or crushed rock, thoroughly mixed. On good soil they are often omitted, the wall being built upon a level bed and of

selected stone at the bottom, if the wall is of this material. All chimneys, posts or piers should be provided with proper footings, same should extend beyond the face of wall from 6 to 8 inches. The basement walls of a modern frame house of ordinary size built of stone need not be more than 18 inches in thickness, or 4 inches greater for a brick house. If the wall is concrete in proportions as stated for footings, it need be only 12 inches in thickness for the frame house and 16 inches for the brick house. A good depth for an ordinary basement is 7 feet 6 inches in the clear, which with 3 inches of concrete for the floor, makes a total height of wall 7 feet 9 inches from top of footings. The broken stone beneath the floor is only used in the best work. Externally 2 feet from grade to top of wall is sufficient, allowing space for 3 courses of 8-inch range work. More than this gives a house a stilted appearance, unless it is large.

Materials for Basement Walls

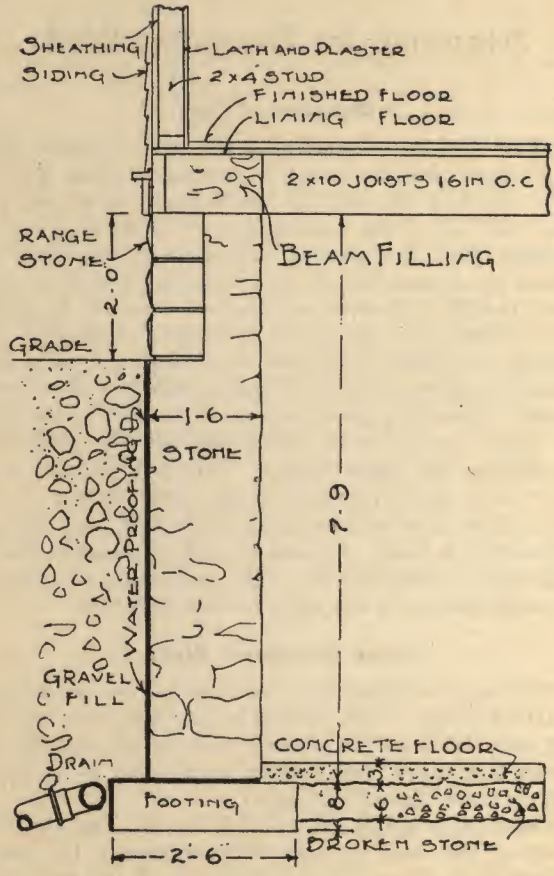
Character of Soil.

UNLESS the character of the soil is known it is impossible to properly determine what will be the best material for the basement wall and the exact method of its construction. The item of cost is a factor that is governed somewhat by the soil. If gravel is encountered in the excavation, a wall of concrete should be cheaper to construct than one of stone, but competitive figures are sometimes surprising. If gravel or crushed rock must be brought from a distance, a concrete wall will cost as much or more than stone. Many now prefer the concrete wall at least up to grade, because it is all in one piece, a solid unit throughout its whole extent. This is largely so in a stone wall set in mortar, but any deterioration in the stone itself, may produce an unstable wall, even though the mortar is good. A concrete wall of properly mixed aggregates containing the right proportion of cement, carefully placed, is not open to this objection.

Stone Foundation Walls.

The stone in foundation walls should be good fresh quarried stone. They should all be laid on a natural bed and the large flat stone should be selected for all jambs and inside and outside corners so as to thoroughly bond the wall together.

The mason should be watched to see that the two faces of the wall are not built separately but there should be a stone the full thickness of the wall, laid as a bond, every four or five feet in the length of the wall, and every two or three feet in height. A mason will sometimes carry up separate faces and fill



(Fig. 1.) Section Through Basement Wall.

in between with spalls, brick bats, etc., and it makes a weak wall. Thin, flat stones should not be used too largely.

It is not advisable to build stone foundation walls for the average residence less than 18 inches in thickness. In very large residences of stone or brick, 20 inches or 24 inches is desirable. If a foundation of brick is preferred, an 8-inch brick wall will answer for a small house, but it is rather light. Twelve inches is the proper thickness for a substantial foundation, at least to grade line. If stone can be obtained, it is preferable to brick for work below ground.

Lime mortar is rarely used now in good work. For a good lime mortar to even sixteen and a half cubic feet (called a perch) use one-fifth of a barrel of lime; and to every barrel of lime used there should be added five-eighths of a yard of sand.

Cement and lime mortar should be made of one part of slacked lime, one part of cement and not more than three parts of clean sand, and for very heavy walls and pier work, it is best to use a straight cement mortar.

Concrete Foundations.

Concrete is an artificial rock made by uniting sand, broken stone, gravel, brick fragments, etc., by means of Portland or natural cement. No material is more enduring or better adapted for foundations, walls, walks, and basement floors. It is advisable to use only the best grade of Portland cement in making concrete. When made with live Portland cement in the proper proportions, the concrete becomes so strong that if broken the fracture will be through the particles of stone, showing that the adhesion of the cement to the stone is greater than the strength of the stone. In making concrete much depends upon the materials used, their proper portions and the manner in which they are mixed.

Concrete Materials.

The best material for good concrete work is freshly broken stone, of sizes that will pass through a two and one-half inch ring or about the size of a hen's egg. Granite or good lime stone are the best. Soft sand stones are not desirable. Pieces of hard broken brick are acceptable. Clean gravel is allowed by the ordinances of some cities. Whatever the material, it must be free from all dirt and be perfectly clean. The sand used should be clean, sharp grit sand, free from dirt or loam. Sufficient sand should be used to fill the voids between the coarser materials. It is usually estimated that about one-half as much sand is needed as the quantity of stone or gravel used. Gravel should be washed and crushed stone screened before using.

Mixing Concrete.

The best manner of mixing concrete is by machine process, but as it is not always profitable to set up a machine for a small amount of work, the following process should be followed: First, prepare a tight floor of planks; or, a still better way is to have a portable sheet iron mixing pan with the edge turned up about two inches (2 in.) for mixing the materials. Upon this should be spread the sand and cement in measured proportions. They should then be thoroughly mixed with shovels and hoes. Then the stone or gravel dumped on top and the whole thoroughly worked over dry with shovels. Then it should be again worked over while water is being sprinkled on it from a hose. Only as much water should be added as is required to enable the sand and cement mortar to entirely coat and cause to adhere all the particles of rock or gravel. The water should be clean and not too cold. A temperature of about 65 degrees is best. Concrete should not be allowed to freeze, for it will not set while frozen and when the moisture thaws it will fall apart if the

forms are not still in place. In warm weather it should be protected from drying out too rapidly, for cement reaches its maximum strength only when damp. If concrete dries too quickly, it is liable to crack from contraction.

Concrete Proportions.

The best proportions for concrete for all practical purposes are Portland cement, one part; clean, sharp sand, three parts; crushed rock or gravel, five parts. The proportion of gravel is sometimes reduced to four parts.

Concrete Blocks.

Concrete blocks are durable, when properly made, and make, because of the material of which they are composed and the air spaces in them, a comparatively warm house in winter and a cool one in summer.

Concrete blocks are made for eight, nine, ten, and twelve inch walls. Surface dimensions of regular blocks are eight by twenty-four and six by twenty-four inches. Some machines make a block sixteen inches long and this looks best for small residence work.

Besides the natural cement colors, blocks are made in a variety of colors, red, brown, buff, etc. No wall of concrete blocks or a combination of concrete block veneer and brick should be less than ten inches thick and when used as a veneer it should be tied to the brick work with galvanized strips one inch wide in every sixth brick course with an anchor on each brick.

Concrete blocks should be composed of Portland cement, one part, and not to exceed five parts of clean, sharp sand. Or, they may be made of Portland cement, one part; clean, sharp sand, two parts, and three parts of crushed rock or clean gravel of such sizes as will pass through a three-quarter inch ring. The hollow space in the blocks should not exceed thirty-three per cent of the block. Blocks should not be used until they are at least three weeks old.

Waterproofing Outside Walls

BASEMENTS will often require water-proofing. There are numerous preparations upon the market that will give excellent satisfaction. A space from 12 to 18 inches should be left between the wall and the bank, to be filled with broken stone or gravel. This treatment will prove effective under almost all circumstances with which the home builders will have to contend. An exception to this would be a location where the rising and falling of the tide of the ocean is the cause of the difficulty. Among other preventatives may be mentioned numerous compounds manufactured, that are mixed with the concrete.

The cost of introducing a water-proofing compound into a concrete wall would be insignificant at the time it was built and may be considered, even though other preventative measures are also employed. It is advisable to use every care to insure a dry basement.

Most of our readers are chiefly interested in this subject after the mischief is done. The situation did not appear as serious when the house was built as it later proved to be and they are confronted by a condition, not a theory.

It is sometimes considered best to correct a damp cellar from within, rather than go to the trouble of digging out all around the walls, to install drain pipes and water-proofing materials. It may be that shrubbery and walks would have to be disturbed, making a very costly job, with no more efficiency.

There are several ways in which to drain a basement that is filled with water, but perhaps the easiest and most satisfactory way is to install an automatic drainer in a pit in the floor, there being several of these drainers on the market.

Cistern Under Cellar Floor.

A cistern built under the cellar floor, which is by all means the preferable method, should be constructed in the same manner as above, care being taken to keep away from too close proximity of chimneys, posts or walls.

Cisterns should always be provided with overflows which should be built at least twenty feet from the wall of the house, in some convenient place. It can be built of a single course of brick without a bottom, or it may be a large hole filled up with rough stone, covered up.

Cistern Above Cellar Floor.

Building a walled cistern above the cellar floor generally requires square corners, and care should be taken, if the building walls are a part of the cistern, that they be laid in good cement.

Often walls in cisterns are lined with four inches of brick as a precautionary measure. This, however, is not of much importance where the wall has been properly constructed as outlined, for if the outside wall cracks, the brick will go with it; and if lined effectively, the lining must be heavy enough to contain the water and then the outside wall is unnecessary. In laying up the wall, special pains should be taken to lay in large, long, stones, bonding the corners and rounding the cement in them; the inside being cemented as above described. The top preferably should be arched with brick, with iron man hole and cover set in the brick arch, the arch to be held in place by tie rods running through the wall with large washers, and the top of arch cemented.

This kind of a cistern should be filled by means of galvanized iron pipes leading from the down spouts into the cistern.

Outside Cistern.

If the cistern is to be built outside, the top of the cistern should not come within two or three feet of the ground, in cold climates, to prevent freezing, and should have a double cover and curbing built of brick laid in cement, and an 8-inch wall laid on a circle. The cistern should be built jug shaped, lined with 4-inch brick from the bottom and plastered with an inch of good natural cement, and then a finishing coat of about three-quarters of an inch of Portland cement, mixed in proportions of one part cement to two of sand. A half inch of Portland cement might do.

Cistern Connections.

The connections to the cistern under the cellar floor should be made with tile pipes and should run down on the outside, underneath the wall. On the top or length that comes through the ground and forms the connection with the down spouts, this pipe should be an iron soil pipe, as this will avoid cracking or breaking from frost or other causes, so often the case with a tile pipe.

All these little things, of course, add slightly to the expense and are often omitted where the matter of cost is of primary importance.

Details of Basement Walls, Posts, Girders and Joists

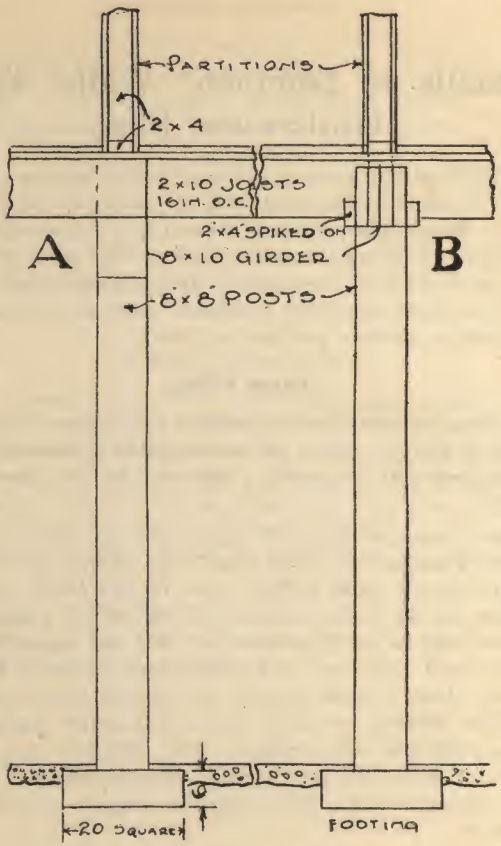
THE posts, girders and first floor joists are so intimately associated with the basement that their consideration is best taken up in this connection. Figure 1 shows the floor joists resting directly upon the wall with a joist spiked across their open ends. The old time wood sill is seldom used, as this method is simpler, cheaper and just as good.

Beam Filling.

After the joists are in position and before the lining floor is laid the top of the wall is filled in between with brick, concrete or stone as indicated by the "beam filling."

As to sizes of joists, it is the average house that is under consideration, the kind that "everybody" might build, having spans seldom over 14 feet long. Joists 2 inches by 10 inches, spaced 16 inches on centers, as shown, will be quite sufficient for first and second floors. Eight and even six inch joists may be used higher, where there is little weight, but plaster cracks will be avoided largely by using good substantial joists well supported and cross-bridged. The designer of a given set of house plans will readily demonstrate the carrying capacity of his floor joists in relation to the load carried.

The position of the girders supporting the joists is an important matter and varies according to kind of heating plant employed. Drawing A, Fig. 2, shows the girder placed entirely below the joists with a partition located directly over it. This is correct where a furnace is to be used, the pipes coming from same passing



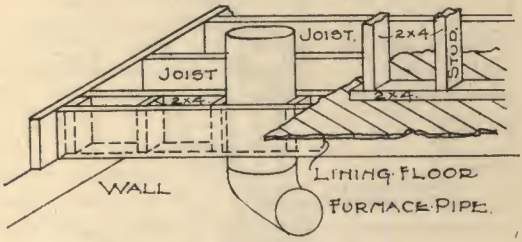
(Fig. 2.) Posts, Girders and Floor Joists.

easily over and above the girder, to reach the space in the partition between the studding, on their way to the upper floors.

Drawing B, Fig. 2, shows the joist framed on the

girder. It is set high with a 2 x 4 spiked to each side. over which the joists are notched and securely spiked at every point of contact. This allows the steam or hot water pipes to be set high with proper pitch for drainage.

Either of these methods of construction would be very unsatisfactory if provided for the wrong heating system. The girder in "B" would have to be partly cut away to allow the furnace pipe to enter the partition, while in "A" the girder would make it necessary to set the hot water pipes very low, in some instances



(Fig. 3.) Furnace Pipe Entering Partition.

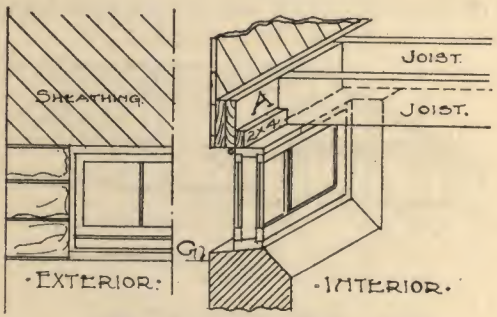
interfering with headroom. The girder in "B" is built up of several joists spiked together.

Such a girder is often superior to one-piece timber because defects can be more readily detected in several individual timbers than in one large timber. Another point to be remembered in framing joists for a house warmed with a furnace is the passage of pipes into a partition that is supported upon the floor joists and not continued down to the basement floor. It is customary to double or even triple the joists under such a partition, but this cuts off any possible entrance of the pipe to the space between the studding.

Openings may be provided by putting short pieces of 2 x 4 upright between the joists, separating them suf-

ficiently to allow the passage of the pipe as in Figure 3. The timbers must all be carefully spiked and if there is much weight upon the partition it must be reinforced by an additional plank on each side, making two on each side, with the 2 x 4 pieces upright between them.

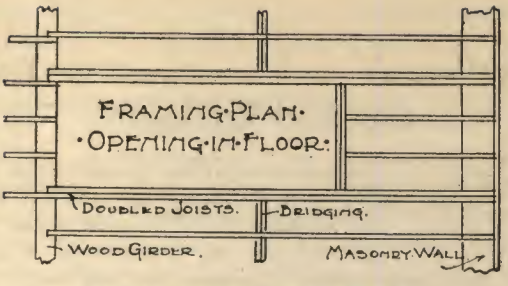
Careful attention should be given to the framing over basement windows, for it is here that weight is contributed by both side walls and joists.



(Fig. 4.) Joists Support Over Window.

Figure 4 shows a vertical section through the window frame, placed in position upon the wall. The joists at either side of the opening are framed upon the wall in the manner before mentioned with the usual limiting timber across the ends. An additional piece, "A," is spiked to this limiting timber, cut between the wall supported joists and showing the window opening. Spiked to "A" is a 2 x 4, over which the intervening joists are notched.

Openings framed in the floor should be limited on all sides by doubled joists. A typical case is shown in Figure 5. Joists should never be placed nearer than 1 inch to the walls of any flue or chimney stack.



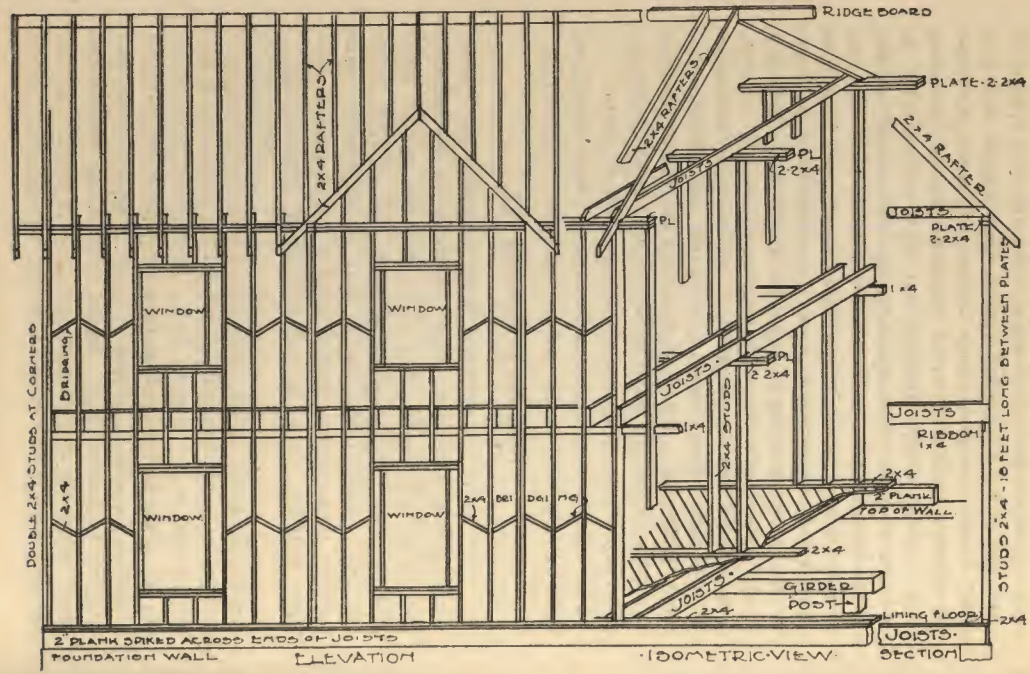
(Fig. 5.) Joists About Floor Opening.

An opening of not less than 20 inches should be left in the floor before each fireplace to accommodate the hearth. The lining floor, which is laid on top of the joists, should be placed diagonally, as indicated in Figure 3, because the finished floor can then be laid in either direction without fear of opening cracks. Having completed the work as outlined above, the house is now ready for the erection of the frame proper or is in condition to lay over until the following spring. It is always advisable to carry the work to this point if the completion is delayed, that snow may be excluded from the basement.

The Frame—Its Construction, Erection and Enclosure

WHAT is known as the balloon frame is still generally employed in the construction of the wood house. The fundamental principles of the construction are preserved, yet the methods as to detail have undergone radical changes. In the early days intricate framing and numberless difficult joints were considered absolutely necessary, but simplicity is now the keynote of the construction. In the methods illustrated the work is shown, not as it might be under the very best practice, but as the modern workman would put it together if left to his own devices and as would be acceptable in most localities.

With the posts, girders and joists erected upon the foundation and the lining floor in place we are ready for the frame. The next step is to spike a 2 x 4 in place about the outer walls directly upon the lining floor, as indicated on the accompanying section. The partitions of the various rooms are then outlined upon the lining floor in 2 x 4s. In each case where a partition has the same direction as the joists they should be doubled beneath it, or otherwise arranged as shown in figure 3 of the previous chapter. The studs are now erected, spaced 16 inches on centers and doubled at corners. No notice is ordinarily taken of the position of openings at this time either in the exterior or interior walls. There would seem to be some advantage in marking the position of doors and windows upon the 2 x 4 shoe before the studs are placed, but it is seldom done. The studs of the outside wall are shown 18 feet long, this being the length commonly used where level ceilings are to obtain in the second story. This gives



(Fig. 6.) The Baloon Frame.

9 feet 2 inches for the first story and 8 feet 3 inches for the second story, both measured in the clear, without cutting the stud to waste. The second floor joists rest upon a ribbon, as it is called, 1 inch by 4 inches, notched into these studs to keep the wall flush on the inside after plastering. See section. The joists may also be notched to receive the ribbon but it is seldom considered necessary, the joist being carefully spiked to the stud.

The interior studs are cut in story lengths only, with provision for a plate spiked across their upright ends, consisting of two 2 x 4s, upon which rest the inner ends of the second floor joists. The interior studs of the second story rest upon this plate and continue up to a similar plate that supports the attic joists. See isometric view, page 25.

The Framing of the Roof.

The rafters and attic joists are framed to a double 2 x 4 plate spiked to the upper ends of the outside studs, the rafters being notched to secure a better bed and the corner of the joists are beveled off in line with the rafter as shown on the isometric view. The upper ends of the rafter are spiked to a ridge board one inch in thickness and in depth as required by the pitch of the rafters. Where rafters coming from different directions intersect, a hip or valley is formed and a hip or valley rafter is necessary to carry the load coming from both directions. This requires a strong timber deeper than the joist framed against it, to include the whole depth of their cut ends. The elevation shows a portion of the exterior with the framing all in place. The studs are shown doubled at the corners, spaced 16 inches on centers, starting at the bottom from a 2 x 4 shoe and ending in a double plate of 2 x 4 at the top, on which rest the attic joists and roof rafters. The

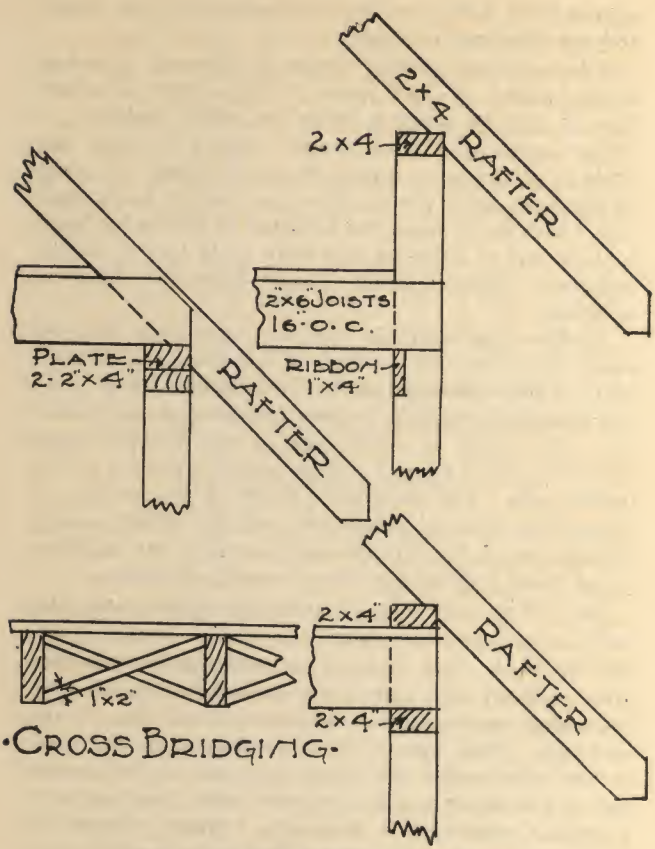
second floor joists are shown resting upon the ribbon and the flooring in place.

Where heavier roofing materials are used it is best to use pieces of 2 x 4 spiked to the rafter and attic floor to prevent sagging, these are called purlins.

Short pieces of 2 x 4 should be cut between the studs of all walls, as indicated, for bridging. As soon as the floor joists are in place they should be bridged with 1 inch by 2 inch cross bridging as shown in figure 7. One line of bridging in a span of 14 feet or less is sufficient. Greater spans should have two lines of bridging.

Window openings are shown with 2 x 4 doubled about them showing method of construction and support. These openings are cut in after the frame is up and should be carefully framed for strength and accuracy. The studs at either side of the window frame should be set to allow a weight pocket from 2¼ to 2½ inches wide. The blind stop, which is that portion of the window next to and underneath the outside casing, should always be wide enough to nail to the studding at the sides, holding the frame securely in place.

Two other methods of placing the rafters and attic joists are shown and a larger drawing of the first method described. Fig. 7 shows the attic joists supported upon a ribbon like that at the second floor level, with the rafter resting upon the plate at the top of the studding. This allows more headroom in the attic at the outer walls, but if the first and second stories are of the usual heights, requires extra long studs at a greater expense. It does give a greater height to the cornice and more space above the second story windows, a feature to be desired. Another section of this same figure seven shows the attic joists resting upon a single plate with an additional plate spiked to them above on which the rafters rest. This requires no more material than a double plate, requires a little



(Fig. 7.) Framing of Rafters, Joists and Plates.

less framing in its erection, and gives a little more height to the building. The outside boarding or sheathing should be dressed and matched, affording strength to the whole frame and keeping out cold. This is some-

times put on diagonally, but as this takes more material and labor, is not always done. It will be found that loose knots and knot holes are in evidence after the walls are sheathed, unless a very superior grade of lumber is used and all such places should be covered with waste pieces of shingle, carefully nailed in place with short nails, from the inside. Care should be taken that all portions of the frame are level and plumb, thus avoiding trouble when the more important finishing materials are placed in position.

All portions should be carefully nailed not only to insure safety but to avoid settlement and displacement so often indicated by cracked plastering.

Second Story Overhangs.

Another precaution that is quite important to be taken, is where the house overhangs on the second story. Sometimes the second story is built out over the porch, or other feature, or it may be only a small portion of the porch; but in any event, the under side of the joist should be carefully ceiled up with matched lumber, closing up the space between the joist on a line with the wall below, by nailing in pieces of joist or boards, to shut off all circulation of air. Then tightly pack with kiln dried sawdust, or carefully grout over the whole bottom or have insulator or sheathing quilt nailed to bottom of floor joists.

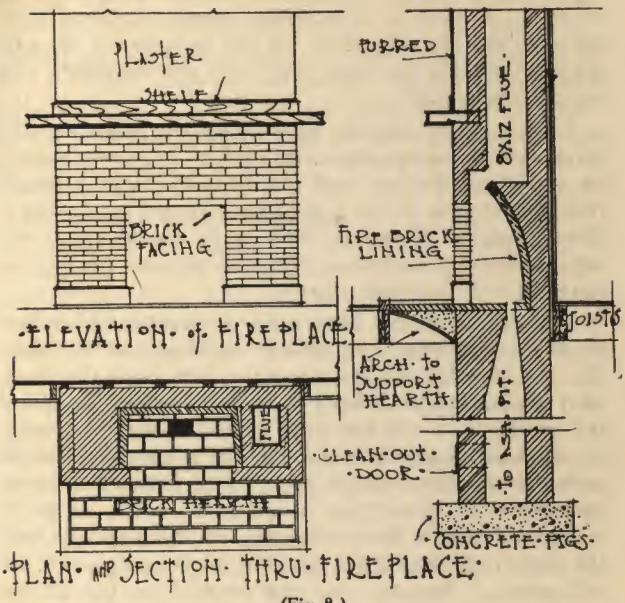
Chimneys, Flues and Fireplaces

THE footings of the chimney have already been touched upon. Chimneys should, by all means for good work, be built from the ground in every instance. If absolutely necessary to have a bracket chimney, the bracket should have direct support upon solid original soil beneath the house. It is usually desirable to build an ash pit in the basement, so as to receive the ashes from the fireplace above, which will, of course, have flues provided for such service. The walls of the ash pit will answer very well if but four inches in thickness. It is desirable, however, to carry down the outside walls of the chimney above directly to the basement floor, to give direct support to the chimney proper. The ash pit should have near the cellar floor, an iron ash pit door and frame, about 12 x 16 inches in size, so that the removal of ashes, when they have accumulated, may be effected. Clean outs for all flues should be left in the basement, as well as openings for furnace, laundry stoves and ventilation pipes. Arches for hearths should be built as shown in Figure 8.

The walls of all fire flues should be not less than six inches in thickness. That is, a four-inch wall lined with two inches of brick on edge. This makes a thoroughly safe and substantial flue. In fact, a safer flue than an eight-inch wall, as joints in the brick are more apt to be broken where the lining is of two inches of brick laid on edge.

A four-inch wall having a fire clay lining and carefully cemented joints, makes a thoroughly first-class and safe fire flue. The two-inch brick lining in addition to the four-inch wall, answers the same purpose and is cheaper than the fire clay lining in most localities. Plastering

the inside of flues is often specified, but if the brick work is thoroughly laid, and the joints are flushed up with mortar and carefully and thoroughly pointed inside, really a better chimney is obtained. The difficulty here, however, is in getting the mason to use this care,



(Fig. 8.)

and watching almost always brings to light some carelessness in this respect. For this reason, it is sometimes safer to specify giving the inside of the flue a good coat of mortar, which, if rich and strong, makes a first-class job.

The only trouble in plastering the flue is that, with age, the creosote in the chimney is apt to disintegrate the mortar, and it will scale off, especially near the top;

but, of course, there is still left the regular four-inch wall with its two-inch lining of brick with joints all broken.

It is very desirable to provide a stone, tile or terra cotta cap for the tops of chimneys, as the disintegration which takes place with a brick top will thereby be avoided. In case a stone cap is used, care should be taken to see that the holes for the flues cut in the cap correspond with the flues, otherwise the shoulders will impede the draught.

A great many masons in building the chimney will leave out the lining above the roof. The lining should be carried to the top, and the flue should be straight from the bottom to the top of the chimney, to insure a good draught. Flues, to draw well, should be of the same size from bottom to top and as near straight as possible, with no sharp turns.

A fire place should have a flue at least 8 x 12 inches in size. Care should be used in building the fire place that the arch for the top is not too high from the floor, as it is much more difficult to obtain a good draught if this is the case. A fire place opening 30 inches wide, for instance, should have an opening not higher than 28 inches from the finished floor. The finished opening should not be more than 26 in.; 24 in. or 25 in. would probably insure a better draught, on the principle that the higher the fire place opening is, the more cold air will enter. The arch over the opening should not be more than 4 inches in thickness, and should be cut away so that there is a slope back toward the flue; and not a thick shoulder against which the smoke will strike and puff back into the room. The fire place flue should extend directly from the center of the fire place, and should it be necessary by reason of fire places above, or other features, to carry the flue to one side, it should turn by an easy slope to the point required.

Round flues, of course, draw better than square flues; and if flue lining is to be used it should be a round lining and should have joints tightly cemented. If the fire place is very large, the top should be a flat arch, supported by a two-inch iron bar turned up on each end to receive the arch. This bar should be a quarter or three-eighths of an inch thick. Wide fire places for burning cord wood should be at least four and a half feet wide and from two and a half to three and a half feet in height. These should have large flues, preferably circular. These large fire places cause a large amount of labor and expense if they are to be made use of to any great extent, and are generally impracticable, though quite picturesque.

In building the back of the fire place and throat, it is desirable to slope the sides a little toward the center; that is, carry the back up straight for six or seven courses of brick, or a height of, say, 15 or 16 inches from the hearth; then gradually bring the brick forward so as to contract the flue toward the top of the fire place, thus insuring a good strong draught. A damper on the front of the chimney, which may be thrown back when the fire place is in use, or entirely closed when not in use, is generally provided, and is desirable where economy of heating in cold climates is an object, for, of course, if the fire place is not in use, a large amount of warm air from the room is sucked out, much more than is necessary to get good ventilation. This damper should be built at the top so as to open back the full width, leaving no shoulders at sides, top or bottom. The lining of a fire place should always be of fire brick, the objection to fancy cast iron being that it will get black and rusty, and be not at all ornamental if it is expected to make practical use of the fire place. Where the mason has not followed instructions, either from lack of knowledge or inclination, and has built the chimney and fire place improp-

erly, a smoking chimney can sometimes be corrected by placing a small hood of metal across the top of the fire place to lower the opening. This should be brought over at the top, so the flap will fasten on the face of the arch, and prevent the smoke from puffing out.

Just as soon as a brick chimney is finished, the brick work should always be examined to see if the flues are thoroughly clean; and it is well to start a fire in all fire places in order to make sure the draught is perfect.

Areas.

Areas to light laundry windows, etc., may be built with either brick or stone, and in either case, to get a good job, they should have a coping stone slightly wider than the top; or, the wall should be finished with a coat of cement. The bottoms of these areas should be of brick laid in loose sand.

Electric Wiring

THE installation of electrical wiring should be carefully planned, and executed at the proper moment during the construction of the house in order to get the best results. The location of a push button should not be left to chance, or to the convenience of the wireman, but should be determined chiefly by the probable arrangement of the furniture. In a bedroom it should be placed at a point within easy reach from the bed, and also be convenient in the room. In the other rooms it is generally best located near the door. In no case should it be placed in the middle of a wall space which would possibly be occupied by a large piece of furniture. The switch controlling the electric lights in the room should be carefully located, as a rule, near the entrance of the room, not behind the door.

In wiring buildings it is only necessary, in order to insure good workmanship, to require that the rules of the National Board of Fire Underwriters be observed.

In addition to the points covered by these rules, it may be well to see that the wiring is done in a systematic, workmanlike manner, since care in the work indicates safety in the result. See that the wire in places which will be concealed when the building is finished, is of the same quality as that which appears at the light openings, and that the quality comes up to the specifications required by the rules. Careful workmen take pains to run the wires as if they were bare wires, so that the insulation becomes merely an additional safeguard in the work, and is not absolutely depended upon by itself. If done in this way, and the insulation becomes rotten and drops off, or is eaten off by mice, the circuit will still be safe. Observe that por-

celain tubes are used in all places where wires pass through joist or partitions, or in dangerous proximity to other wires or metal work of the building. In case of conduit work, see that the conduit is properly inclined so that it will not form a trap for water, if by any chance it should run into the pipe. See that the fuses in the cut-out boxes are of a size to protect the smallest wire in the circuit beyond. Fuses should be figured on this basis rather than on the number of lamps the circuit may be called upon to carry.

It is well to have the fuse blocks plainly marked with the size and capacity of the fuse wire, so that in the case of a fuse being blown, it can be replaced with the same size. A diagram of circuits fastened to the door of cut-out cabinet would be found convenient. Sockets and fittings should be obtained from manufacturers of recognized standing. Switches should show whether the current is turned on or off, otherwise a switch may carelessly be left turned on at a time when the service is not given, and lights will be wasted when the current is turned on. See that switches are located at a convenient position, preferably near the entrance door of a room and a proper height. Switches should be secured to the wall firmly, since they are apt to work loose.

Bells.

Bell wiring appears so trivial a matter, that it is often sadly neglected, to the great inconvenience of the householder. There is no excuse for omitting a bell system, since the expense is so trifling, when installed before the plastering is done.

There is almost always an electric front door push, which should generally be located to the right of the door, at a height of about 40 inches. Pushes in rooms should be located generally near the entering door, and a space that might be wanted for a piece of furniture should particularly be avoided.

Annunciator wire which is commonly used in bell wiring is much inferior to "office wire," which should be used unless rubber covered wire can be afforded. "Twin" wire, which is furnished in both office and rubber covered, will save half the time in wiring, and will give the best satisfaction. Joints should be absolutely forbidden in new work, and in repairs, if necessary, should be always soldered and taped, but never concealed behind the plastering. It is better to run wires upon a regular system, avoiding all diagonal runs, which makes wire so difficult to locate in case of repairs. The increased cost of wires adds almost nothing to first cost. Bell wires should avoid electric lighting wires, and be installed with equal care.

In wiring a house it is well to provide for plenty of outlets for attachment of the various electric devices now on the market, such as an outlet under the dining room table, for an electric toaster; an outlet in the laundry, for an electric iron; and one for a sleeping bag connection if there is a sleeping porch on the house.

A base receptacle for a connection with the reading lamp on the living or library table.

The hall and stairway lights on the first and second floor should be controlled by two three-way flush push-button switches so that light can be turned on or off at either bottom or top of stairway.

Speaking Tubes.

These should have the sections securely and tightly joined and run in as straight a line as possible with very few turns. See that the outlets are conveniently located and at the proper height. Outlets should at least be fitted with nickel plated mouthpieces provided with whistles, and flexible ends with mouthpieces attached will be found well worth their extra cost in their convenience.

Plastering

THE item of plastering is important, as the appearance of the walls depends so much upon it, no matter how it is decorated.

It is advised that a good patent plaster of well known manufacture be used, applied as directed by the maker. All possibility of settlement of the house should be reduced to the minimum by care in its construction that plaster cracks may be few. It is difficult to conceal a crack once it is made, for wall coverings soon separate along the lines, unless of woven material. Small cracks occur, due to shrinkage of timber about openings, and are well nigh unavoidable.

Wood lath is usual for interior work because of its moderate cost, but expanded metal is more desirable if one can afford it.

Back Plastering.

Back plastering between the outside studs is sometimes done, but cracks often make it almost useless.

Insulating Material.

Building papers are better put between the studs as a substitute for back plaster to insure a warm wall.

Those prepared with rosin, tar products, etc., are used upon the sheathing, roof boards and between studdings. Some are very tough, waterproof and of lasting quality and such are recommended.

Those that dry out and become brittle are of little value because they crack, allowing the wind to penetrate.

Good protection is afforded by hair, sea grass, or linen products, sewn between building paper. Various

grades are manufactured and are used not only as insulation but for deadening.

Good insulating material is made of hair, flax fibre or sea weed between paper, and is used on walls between studs, outside upon the sheathing or as a deadener between floors.

Lath.

Use a good grade of wood lath free from bark, sap or loose knots, and should be placed five-sixteenths of an inch apart on ceilings, and a little less on side walls. Green lath are best, as seasoned lath are too dry. If lath are dry sprinkle them well an hour or two before the plaster is applied, which gives them time to swell before the plaster sets, and thus prevents buckling and lath cracks.

Grounds.

Grounds should be three-fourths of an inch for lath and one-half inch on brick walls; on wire lath three-fourths of an inch, and three-fourths of an inch on plaster-board.

Sand.

Use a good quality of sharp, moderately coarse, clean sand, free from clay or loam, as dirty sand will not make so strong a wall, and will take more plaster, also hasten the setting.

Mixing and Applying.

In one end of the mortar box put eight common wooden pailfuls of sand (struck measure) and 100 pounds of plaster. Mix these thoroughly while dry, then add sufficient quantity of clean water to make stiff mortar, and mix thoroughly, then apply to the walls and ceilings as soon as possible. Then with a darby and straight edge bring it to an even surface and straighten the corners. Sprinkle the walls slightly

when using the rod and darby, but use no more water than necessary to make the tools work easy. Keep tools clean.

Covering Capacity.

No exact figure can be given as to the quantity of Cement Plaster required for 100 yards of wall, as the conditions vary so much in different localities, such as quality of sand, depth of grounds, number of coats required, and lathing, but for two coats 900 pounds will be found sufficient for lath work, and 600 to 900 on brick walls, with 150 pounds of Finishing Plaster for putty coat.

Two-Coat Work on Wood Lath.

Apply the base coat in the usual way until time to darby, then sprinkle sparingly with water. Darby lightly, thus not forcing the mortar through keys of lathing. Do not apply more at one time than you can darby before the material begins to set. Cut down all angles with a trowel before the plaster sets to prevent cracks from shrinkage. When the corners are cut through with a trowel in this manner it will leave it free to shrink in drying and thus prevent ugly cracks that sometimes disfigure the walls. These instructions apply not only to room corners, but especially to corners around flues and chimneys. After the material has set, the wall is then ready for whatever kind of finishing coat is desired.

Dry Three-Coat Work.

On account of lath being liable to buckle more or less, and to avoid trouble, we would advise doing three-coat dry work, first putting on a scratch coat, scratching the surface with a broom before the plaster sets and allow the first coat to dry before the second coat is applied. The second coat is then put on and can be floated if desired, or left smooth ready for the finishing

coat. It costs a little more money for labor for this kind of work, but it is money well invested, because you obtain the best possible results.

In no case attempt to work the plaster after it begins to set, as failure is certain.

Apply a scratch coat, lightly covering the lath. After the first coat has set firm and hard, apply the second coat, bringing it to a true surface ready to receive the finishing coat. In all cases darby lightly and use water sparingly.

Summary.

Before material sets clean jambs thoroughly and cut mortar away from base.

Keep temperature of house above freezing point in winter, and keep out hot blasts of wind in summer.

In winter never close a building tight where artificial heat is used. Leave a little ventilation at top of windows.

Mix at one time only what you can use in a half or three-quarters of an hour.

Clean mixing box after each gauging and keep tools clean.

Dirty water or dirty tools will cause plaster to set quicker.

If your work shows white, soft spots after drying, it is evident that the material was not properly mixed or that the walls dried too quickly. Wet the white spots with clean water and brush until they set up.

Brick walls have great suction and they should be sprinkled well before plastering.

Corner Beads.

All plaster angles should be covered with corner beads. The metal corner beads are nailed in place before the plastering is done. These are more satisfactory than the clumsy unsightly wood beads that are put on after the plastering and decorating is done.

Exterior Materials

THE materials appearing externally should be selected with a view to durability and architectural beauty.

Wood.

Wood has always been of service, and if properly protected by paint and stain will give excellent satisfaction. The necessity of giving it constant attention is a source of expense and an argument against it.

The ease with which wood can be worked into beautiful mouldings, makes it specially valuable in carrying out distinctive architectural styles. In combination with other materials many charming effects may be obtained.

Various Kinds of Brick.

Brick is a building material which in its general characteristics needs no introduction to the public. Brick is manufactured in an almost endless variety of shapes, sizes and color tints and is composed of clay, sand-lime, concrete and even glass. Clay is found in different colors and is treated in various ways to produce the many effects as to color and texture now upon the market.

The skillful mixture of different clays and various methods of burning produce surprising results.

The dry pressed brick is made from carefully prepared clay pressed with a minimum amount of water.

The sand-mould brick is pressed in mud form into sanded moulds, hence its name.

The wire cut brick in either smooth or rough surface is what is commonly known as mud brick, a greater amount of water being used in its manufacture and

where special roughness is desired the lumps are allowed to persist, thus making more resistance to the wire while in the plastic state, producing the extra rough surface.

Another surface is made by water dropped upon the brick giving it a beautiful texture. Repressed brick are again placed in the mould and pressure applied after cutting. This is often done to the vitrified paving brick which in skillful hands has found a place in certain positions even for residence architecture.

A very effective brick face is produced by a fracture of the face lines by great pressure after the operation of burning is entirely completed. Several bricks are allowed to fuse and the resulting fracture or rock-face, as it may be termed, is very pleasing, especially for work close to the eye. Rough effects in brick work have a great vogue today and the house built of it will have a wealth of harmonious color and a picturesque feeling of its own.

Moulded bricks are obtainable in various shapes and in the more classic structures find a well-merited position.

Clay bricks are also given an enameled surface in various colors and are very appropriate for certain situations. The salt glazed brick may be mentioned as having a slightly glazed surface which resists the action of deleterious properties in the atmosphere of cities and is therefore desirable because dirt and grime do not enter in its substance.

For the more utilitarian purposes are the solid common brick, the hollow brick and also the hollow tile which may be used for backing and if of good quality will readily carry the joists bearing upon it.

Sand-lime brick are used for both face brick and backing and may be had in this market in white, buff, and blue-gray tints.

Glass brick have not come into general use as yet, in this country. It will be readily seen that if this material ever becomes a serious competitor with other bricks, a wide field of possibilities will be opened which will have a wonderful influence on our architecture, because of the wide range of beautiful colors obtainable.

Brick is indispensable to some styles of architecture and in combination with stone and terra cotta with suitable bond, in appropriate jointing, gives a wall texture and color that is unsurpassed.

Cement Brick.

Brick are made of cement in almost any shape, size and color. These will make a good substitute for the clay brick in localities where clay for the manufacture of brick is limited.

Stone.

Stone used exclusively usually looks rather heavy in small residence architecture, unless of a rustic character. Rubble stone in very wide mortar joints is very effective in the Colonial style with details in wood painted. Cut stone should be used sparingly except in large houses; for foundation walls above ground, sills, lintels and trim, it is unexcelled.

Moulded and carved stone readily finds its place in the house of any size, if carefully designed.

As a material, stone requires little or no attention once it has been properly set in position, an item that will offset the first cost.

Cement Blocks.

Cement blocks of the usual rock-faced order, like stone, look heavy in a small building. Several moulds of face should be used, that each block when laid in the wall will appear different from its neighbor.

It is this distressing lack of individuality, together with poor color and quality of the early cement blocks, that made designers adverse to them. With improved methods and the production of desirable architectural shapes, prejudice to cast stone is rapidly disappearing. When properly made and set, the wall should need no further attention.

Monolithic Concrete.

Monolithic concrete walls, which are poured in a mould are surfaced in various ways which are pleasing and durable. The outer facing of pebbles, or crushed rock is embedded in clay against the inner surface of the outer form. This is washed away after the concrete lining has set, leaving the finishing materials exposed on face, but firmly embedded in the concrete.

Another method is to place the desirable surface aggregates in front of the ordinary concrete mixture, to be treated with acid after the removal of the forms. As only a small portion or layer, in each of these methods, can be placed at a time the effect is not always uniform.

Hollow Tile.

Since 1908 the fireproof hollow tile construction of residences and other minor buildings has progressed from a vague but unrealized ideal to an actual and widespread standard of practice. Thus in a period of five years the art of building as applied to this class of structure has made a greater and more important advance, in all likelihood, than in any previous century. It is, however, not so surprising as may appear, that this change of standard practices has gone so far in so short a time.

When Terra Cotta Hollow Tile was introduced for construction of moderate size, it was simply the opening of a new field for a material that had already at-

tained first rank in the fireproof construction of large buildings.

Two scientifically established facts express the principal advantages of hollow tile, viz.:

1. Well burned clay cannot be destroyed by fire.
2. A dead air space is the best insulation against heat or cold and consequently the best protection against the destructiveness of high temperatures as generated in burning buildings.

Already many building concerns in some localities are erecting the small story and a half residences of 8-inch tile wall above grade at the same cost as those built of frame. This tile wall is then plastered on the outside with cement, usually left "rough cast," then plastered on the inside directly on the tile. For a first-class job, however, we would recommend that the inside wall be furred first, before plastering, the slight increase in cost being well worth while.

For the better class of residences hollow tile is used for reinforcing the floors; this makes a practically fireproof structure, if the roofing material be either slate, tile or asbestos shingles.

Cement Stucco.

Though the use of concrete goes back into antiquity, plastic architecture today seems to be in its veriest infancy and would seem to be asking the genius of this age to give it perfect expression.

The three principal methods of applying cement plaster to frame work is to use expanded metal lath, wire lath and wood lath. In choosing, two factors are paramount. The best foundation for cement plaster is the one which is the least flexible, that is, the one which will allow of the least "come and go" with the wood construction of the wall. The other factor is the permanency of the lath used. More or less moisture gets into the lath as ordinarily applied. The metal

lath should be painted, or better, galvanized, or it will deteriorate or rust in time.

A good method of avoiding cracks is the use of galvanized, crimped steel as furring, fastened 8 inches on centers, to the outside wall sheathing, in such a manner as to allow for the expansion and contraction of the wood structure without disturbing the furring strips.

Cement on patent wood lath, which is self-furring, is also practical. The early English way of criss-crossing the lath is good and has served well in England since the adoption of plaster exteriors. The wall is boarded and papered in the usual way. Furring strips are then laid 9 or 10 inches apart. On these the first layer of lath is laid diagonally. The second layer is then laid at right angles to the first layer and diagonally to the furring strips in the opposite direction. This method furnishes a clinch for the plaster which cannot be excelled.

The advantage of this form of construction seems to be the fact that the lath forms a ground, flexible enough to resist the "come and go" of the large timbers behind it and does not communicate it to the plaster. The foundation being a continuous criss-cross, there is no place in the surface that a crack can follow on a direct line without meeting a contracting force from the lath crossing in the opposite direction. The lath are placed about one inch apart and it requires only about a third more lath than the usual way and while it should only require a third more lath it usually requires twice as much time in nailing, owing to the method of laying being new to most lathers. This makes it more expensive than patent wood lath.

A method which has found favor with many is that of applying plaster boards as they are called, in sheets directly over the building paper. They are then surfaced with a patent plaster which may be given any of the finishes usually employed. The air space made

by furring out is not obtained in this construction, but furring strips may be used if desired. The density of plaster boards is said to make the air space unnecessary.

While it is cheaper to use wood construction for the frame, masonry is sometimes used as a body for the cement. The wall may be made of hollow tile with dashed exterior. Before applying the cement, however, the tile is given a good coat of dahydratine or similar product, a tar-like paint which prevents all moisture from penetrating into the tile and also prevents any salt or magnesia from coming through onto the cement surface.

Although most cement exteriors are left the natural gray it is often through lack of knowledge of proper methods of using coloring matter in the cement mixture. It is difficult to determine beforehand, without considerable experimenting, the proper proportion of the color pigment to obtain the desired result. Vegetable colors should never be used. Brick dust is often used as a color matter. A pleasing tan shade is obtained by mixing red and ochre with adamant and cement for the dash coat. Cement stains in various colors are now obtainable, applied after the cement coat is complete.

Portland cement and sand or prepared plaster compounded especially for exterior work, are the best. Ordinary lime should never be used because it weakens the mixture and materially delays the set. Hydrated lime, nothing more or less than a scientifically slaked lime, may be used in the first coat to the extent of 10 per cent of the Portland cement and will be found to greatly assist the workman. Prepared plaster, however, should be used in accordance with the instructions of the manufacturers.

Various Kinds of Exterior Stucco.

There are three popular finishes for exterior work: "Float," "Rough Cast" and "Pebble Dash." Float finish is two-coat work and therefore the cheapest of the three. It is best adapted to surfaces of small area. Rough cast and pebble dash are applied in three coats and are to be had in great variety of textures and color. Washed pebbles, crushed stone and even cinders are used to get the desired effect.

Protection of Exposed Points.

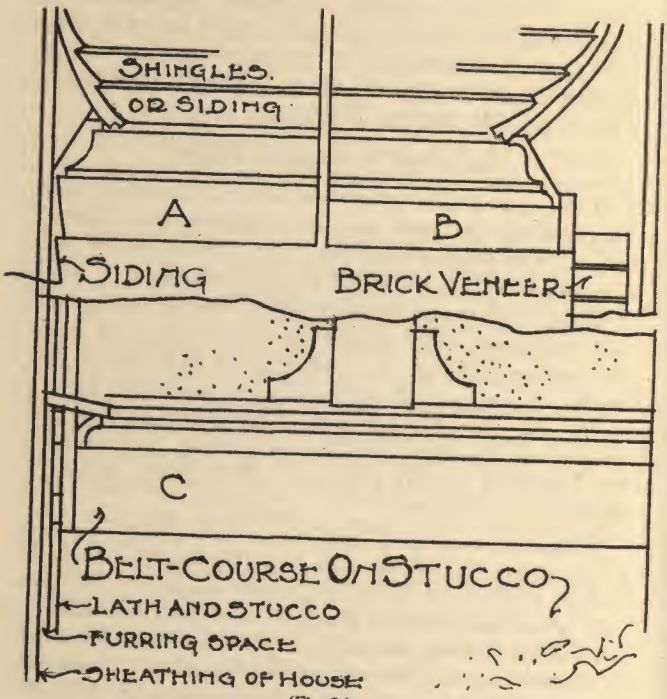
When cement is used in this manner, especially when it is applied on metal lath, it is advisable to have all top surfaces above protected. The cornice should have a good protection with either an overhanging or built-in gutter to carry off the roof water, and all coping, sills and balustrade rails should be either wood or stone and project through the wall, to shed the water. The cement is always more or less porous, and when applied to the exterior of a wall it absorbs more water than it does in the concrete block or brick form, the latter being subjected to high pressure, which makes it almost impervious to water.

When the cement is applied on metal lath, a metal corner-bead should be used for all corners. This, of course, is not seen after the cement is applied. Cement over sheathing makes a good, warm house, especially if furred out and the frequency of painting is avoided and the appearance in connection with woodwork, cornices, belts, half-timbers, etc., may be attractive, if skillfully handled.

Stucco work should never be done after the temperature falls below the freezing point unless it is well protected. In our northern states where the house is completed late in the fall the stucco work is allowed to go over till spring.

Combination Effects.

Of the materials noted for use externally, all may be used in combination upon the same structure with the exception of stone with cast cement.



(Fig. 9.)

Only in a few instances is this permissible and then only when the cement is not apparent as such, but as a successful imitation of stone. Brick, stone or cement with wood and stucco combine very nicely as in the English half-timber style.

All stucco houses with tile roofs successfully carry

out Spanish and Italian motives, accompanied by wide spreading cornices as a protection to the stucco wall.

Belt Courses.

Some designs have a moulded horizontal course dividing the wall surface, called a belt. Often the materials are of a different kind above and below it but not necessarily. The course A (Fig. 9) shows a simple treatment for a sided house with shingles or siding above. Course B shows a belt with brick veneer below and siding above. The belt C indicates a course for a house finished in stucco with plain wall surface below, half-timbered above. The stucco is applied to expanded metal lath as shown on the drawing with a furring space, or upon plaster board which is nailed directly to the sheathing of the wall over building paper.

Oftentimes in the larger type of square brick houses with a hip roof, the main cornice serves as a belt, and is placed just above the top of the second story windows.

The outside brick walls are then carried on up above the top of the cornice some 30 to 36 inches with stone coping, this if the house be of the right proportions, is very effective. If sufficient height is thus gained the attic windows may then be placed in the side walls instead of building dormers on the roof.

This gives the appearance of a three-story house.

Roofing Materials

Wood Shingles.

THE most common of all our roofing material is the wood shingle. Cypress, redwood and cedar shingles are best. Redwood possesses the advantage of being less inflammable than other woods. Ordinary shingles vary in width from 2½ to 14 inches.

Four bundles usually make up 1,000 shingles, which are equivalent to 1,000 shingles 4 inches wide.

Dimension shingles are sawn either 4, 5 or 6 inches wide.

Area Covered by 100 Shingles.

Laid	Area Covered, Sq. Ft.	No. to a Square.
4 in. to the weather	100	1,000
4¼ in. to the weather	110	910
4½ in. to the weather	120	833
5 in. to the weather	133	752
5½ in. to the weather	145	690
6 in. to the weather	157	637

Add 5 per cent for hip or for valley roofs and 10 per cent for irregular roofs with dormers.

With a rise of roof from 8 to 10 inches to the foot lay shingles 4 to 4¼ inches to the weather, with 10 to 12 inches lay 4¼ to 4⅜ and on steeper roofs lay 4½ to 5 inches to the weather.

Asbestos Shingles.

These shingles are composed of cement and asbestos, manufactured under patents, and make a very durable roof, thoroughly fireproof.

They may be had in gray or in color and are laid

upon slater's felt over tongued and grooved boards securely nailed to the rafters.

Sizes and methods of laying vary, all of which is covered by the directions of the manufacturers.

After the first cost there is little or no expense for repairs if properly applied, as the material is practically indestructible.

Asphalt Shingles.

Shingles of asphalt, manufactured under patents are now upon the market which are 15 inches long and 8 inches wide. The surface is of ground mica, which produces a hard, attractive surface. They are light, requiring no additional strength of framing, are fireproof and are said to equal a covering 12-ply in thickness. Laid like ordinary shingles, four-penny wire nails are used. They are guaranteed for twenty-five years.

Slate Roofs.

Slate roofs are, by all means, preferable to shingle roofs, where the expense can be afforded. In many sections of the country the difference in cost does not amount to much. This would apply to sections not far from quarries and where lumber is high. Then, with slate roofs, like everything else, there is a vast difference not only in the quality of slate, but in the method of using it; and if a good piece of work is desired, the roof framing should be strengthened somewhat to provide for the extra weight the slate will involve. It is generally advisable to use 2x6 rafters, at least, when about sixteen feet in length; and should the length exceed twenty feet, they should be of 2x8 lumber, and in any event, sixteen inches on centers.

In many sections, builders are in the habit of putting slate roofs on much lighter framing than this, even spacing 2x4 rafters twenty and twenty-four inches apart to carry a slate roof, but the results cannot be permanent and satisfactory. The roof boards should

be of dressed and matched lumber, well nailed. Over the roof boarding should be laid a covering of at least two ply No. 2 tarred felt, and 10x16 slate, which is the size best adapted for ordinary work, should be laid thereon with not less than a three-inch head lap.

Good slate should be both hard and tough. Colors vary from dark blue, bluish black, and purple to gray and green. Red slate is also obtainable and makes a very effective roof. Holes are made in the slate for nailing and felt is introduced beneath the slate upon the sheathing. At the ridge valleys and hips the slate should be bedded in elastic cement. Slate is brittle but lasts a long time if not damaged by anything other than the usual exposure to the elements.

Terra-Cotta Tile Roofing.

This material comes in several patterns after Spanish, Italian and German motives and is glazed or unglazed in many beautiful colors.

It gives an excellent effect with masonry or stucco construction and a harmonious selection can be obtained readily owing to the range of color in the tile.

A feature which is of interest is the glass tile, of identical pattern, used for skylights. As the glass and terra-cotta tile interlock, there is no break in the roof lines, the surface being continuous.

Metal Shingles and Metal Tile.

Shingles and tile patterns are now made in metal and are very artistic and durable. Preservative coatings are applied which give color and prevent rust. Copper turns green when exposed to the weather and is prized by many as a roofing material because of this fact. It needs no coating. Only ordinary care and ability are required in laying and full directions are furnished by the manufacturers.

No extra strength is required in roof framing.

Tin Roofs.

A good tin roof properly put on and kept painted will last from thirty to forty years. The first coat of paint should not be applied until the rain has thoroughly washed off all oil and grease.

Only rosin should be used as a soldering flux and all lumps left upon the tin should be removed as soon as the tin is laid.

Felt paper should be placed under the tin as a cushion and to deaden the noise of the falling rain. The durability of the roof is increased by painting on the back before laying. A good paint for tin roofs is 10 lbs. venetian red, 1 lb. red lead, 1 gallon pure linseed oil. Roofs of less than one-third pitch should be made with flat seams and steeper roofs should have standing seams from eaves to ridge. Nails should never be exposed. Only well known brands of tin should be used, in weight as manufactured for the purpose.

Slag or Gravel Roofing.

This is an excellent covering for roofs with a pitch of from ⅜ to ¾ inch per foot. In cold and damp countries the pitch may be as much as 4 inches per foot, but less is desirable.

A 3-ply gravel roof of 12-lb. felt and 70 lbs. of straight run, distilled pitch, will last from four to seven years. A five-year guarantee is usually given by the roofer. Rosin-sized sheathing paper is laid first over the roof boards with a lap of one-inch, nailed only enough to hold in position. Three layers of tarred felt are then lapped one over the other to produce three-ply work, each layer being carefully coated with pitch at the lap, and the whole covered with a uniform coating of pitch into which is embedded, while hot, slag or gravel. Coal tar pitch is used, distilled from American coal tar. For nailing, three-penny roofing nails are used, driven through tin discs.

Flashings are made of heavy tarred felt turned up against chimneys, walls, etc.

Ready Roofing.

There are many brands of ready or composition roofing, as it is often called, upon the market. It comes in rolls and anyone can apply it by simply making a lap of 2 inches, coating it with cement and nailing every 2 or 3 inches. The cementing material, nails and discs are packed in the center of the roll and nothing is required other than a knife and a hammer. A warm day is the best time to lay it, because the roofing is more pliable under heat, and if not carefully placed in position will wrinkle. If water runs off readily the wrinkle will not matter, but is very apt to be damaged if walked upon.

Any pitch of roof may be covered with this material. It is best to paint once in three years. All flashings may be made of it.

Some roofings are made with cut edges to represent shingles or tile effects and give a very good effect.

Some are best for side walls and roofs, others for decks and balconies, and some are specially made to walk upon. These materials are accompanied by careful instructions from the manufacturers, who in most cases guarantee the goods.

Asbestos Roofing.

This may be had in sheets or rolls and is applied in the same manner as other ready roofings. It possesses some advantages peculiar to its composition and is of special value in some positions.

Asbestos Roofs.

These are frequently used on factories, warehouses and such a class of work, but seldom on residences. In case it be used, the very best of materials are recommended; the courses should be lapped smooth, and the nailing secure and frequent.

Galvanized Iron and Tin Work

ALL tin should be of the best manufacture. Taylor's (Old Style) and N. F. 32 or 40 lb. coating made by American Sheet & Tin Plate Co. are well known and reliable makes. For flat decks, roofs, etc., Galvanized Toncan Metal is substituted for tin. This is somewhat heavier and more expensive. The coating on cheaper tin, such as is known as charcoal tin, is apt to be thin and defective. For cheap work the best grades of the latter may be used, but in every instance the protection by painting should be very carefully looked after. The best makes of tin last as long unpainted as the cheaper tins will when carefully painted and kept so, and a good protection of paint will lengthen the life of any tin.

All tin roofs or decks should be of tin 10 x 14, 14 x 20 or 20 x 28 in size, and what is known as I-C thickness, laid either flat or standing seams, as desired, generally flat seams. Each sheet should be stamped with the brand, showing its manufacture and thickness. The sheets should be well lapped and soldered and flashed down over the edges three-fourths of an inch. All flashings and counter-flashings, caps, etc., should be of the same tin. Gutters and valleys, tin hips, etc., should be of the same tin, only I-X in thickness. The gutter tin should extend up under the shingles not less than ten inches; the gutter lining should be laid on a good foundation, prepared by the carpenter and so graded as to allow no sagging or hollows in which water could stand.

Valleys should be at least fourteen inches wide, and wider if required, extending under the shingle on either side not less than five inches. The tin for valleys

should be well lapped and soldered; and in all cases, a good quality of roofing paper should be laid under the tin.

Flashing and Counter-Flashing.

Chimneys should be thoroughly flashed with lead laid in between the joints of chimney when same is built, and counter-flashed with tin.

When two valleys come together at chimney, the tin should extend a sufficient distance up the roof with the shingles cut away, that there may be no danger whatever from leakage and snow or water backing up.

All tin work should be given a good coat of metallic paint, well spread, and dried on the under side before being laid.

Gutters should be connected with three or four inch corrugated and galvanized iron down spouts, as may be required, by means of sleeves. The down spout should be thoroughly fastened to the side of the house with conductor hooks and should run to grade line, where there should be an elbow to throw water away from the house, or, better still, connected with a four-inch cast iron soil pipe and a tile drain running to either cistern or dry well. These dry wells should be located about twenty feet from the house, if possible. The digging of the dry well and its connection with the down spout at grade line and cistern connections may be included in the mason's contract, the plumber's contract, or the tin work. It is more properly the mason's or the plumber's work, particularly the latter, though the laying of tile pipe is often done by the mason.

Painting, Staining and Finishing

External and Internal Effects, Treatment of Finish, Walls and Floors. The Exterior.

COLOR treatment depends entirely upon the architectural style, the materials employed, and environment.

The Wooden House.

Stained shingles and painted siding are often used in small houses with trimmings of a light color. Good color combinations are made with two shades of brown for shingle and siding, the upper shingled portions receiving the darker tone, roof shingles of moss green stain and trimmings of ivory white paint including sash. Or, the ivory white trim may be used, with dark green for shingles and siding of the body, and a gray or brown stained roof.

Where the foundation of the house is of gray stone or brick with the same general tone on porch floors, a good combination is a rich, dark red for walls, dark moss green for the roof stain, with dark green trim. The combinations we suggested are especially appropriate for the bungalow or cottage.

For the more symmetrical house, or those of Colonial motives, lighter colors are necessary and may be pure or ivory white, colonial yellow, light or ash gray. The white is often used very effectively for trimmings, with either of the latter for body coats.

Outside shutters or blinds are suitable to this type and should be painted a rich leaf green like the surrounding trees or white like the trim.

A well kept lawn and green trees form an appropriate setting for such a house and color scheme.

There are several good grades of ready mixed house paints now on the market, but some prefer to mix their own materials from pure white lead and linseed oil.

Application of Exterior Paint.

For good results use enough pure raw linseed oil, on new or very old surfaces, in the first and second coats to properly fill the wood, and prevent absorption of oil and binder from the paint film, and still leave enough oil to bind the pigment thoroughly.

If new surfaces are hard and resinous add a liberal percentage of pure spirits of turpentine to first and second coats to insure adequate penetration and assist the drying to a proper surface for recoating.

Use equal parts of pure spirits of turpentine and pure raw linseed oil for the hard surface of old painted work, thinning the first coat to insure penetration and homogeneous drying of the new coat of paint.

Paint should be spread out in thin coats and brushed well into the pores of the wood.

A 5-0 or 6-0 round or oval brush is better than a flat wall brush. A new house should contain no wet plaster or basement when it is painted. If siding absorbs moisture the paint will blister or peel. Avoid heavy frost, fog or dew. It is not good to paint in the direct heat of summer sun. Keep in the shade as much as possible. Fresh mortar beds will destroy the life in oil because of moisture and fumes which the oil absorbs if paint is used near them.

One coat should follow another before it gets too hard to have the proper "tooth" necessary to give the next coat the proper grip upon it.

Leaky gutters and down-spouts often cause paint to blister and peel.

When the final coats are to be of lead and zinc colors, yellow ochre and mineral reds, such as venetian, iron ore, and other oxides, as well as Prince's mineral, etc.,

should not be used as primers, because when mixed dry, do not combine readily with linseed oil. Unless ground, certain particles are not thoroughly saturated and upon being applied to the surface absorb oil, leaving the film of ochre or oxide without any binder, resulting in peeling and perishing.

On account of the difficulty of spreading these pigments they are often applied in a very thick coat, which if allowed to become perfectly hard forms an impervious surface, preventing the proper adhesion of subsequent coats of paint.

Exterior Varnish Finish.

Only the best grade of varnish, specially manufactured for outside work, should be used, as the constant dampness will affect an inferior material seriously. The stains for exterior doors should be non-fading and the varnish must form a thoroughly impervious coat. It is best to use only goods of some well known manufacture according to directions.

Shingle Stains.

These stains not only preserve the wood, but produce beautiful effects in the many colors in which they are manufactured. Samples are usually obtainable from manufacturers' agents.

Stain should be thoroughly mixed before using. When delivered in a keg, the head should be removed that the contents may be mixed with a paddle. Some painters try to accomplish this with a lath through the bunghole and it is always unsatisfactory because the pigment is not well incorporated with the liquid, resulting in a loss of color and strength. It is better to employ a thoroughly practical man who will do things right rather than the easiest way, even if it costs more.

Flooring

FOR a concrete floor, the cellar bottom should be first generally leveled, then pitched to any desired point, so in case water should get into the cellar, it could be carried off, if it was desired to go to the expense of drains for this purpose. It should be leveled to about four inches below finished floor level, and then concrete should be made of broken stone or coarse gravel, three parts; good, clean, sharp sand, one part; and natural cement, one part. This should be finished with a coat of Portland cement, the thickness depending upon the character of the job desired. For a strictly first-class piece of work it should have three inches of concrete, and top coating of strong Portland cement from three-quarters of an inch to an inch in thickness, in proportions of one of cement to two of sand. A fair job could be had with a half-inch coating.

Should a wood floor be desired in the basement 2 x 4 should be bedded in the concrete as sleepers for nailing the wood flooring.

For cement floor on porches, the underfill should be well tamped down; the cement floor is then laid same as above described or this is sometimes reinforced with steel rods.

Brick or tile is very often used for porch flooring. The brick should be a vitrified paving brick laid in cement mortar with well filled joints.

Tile floor is the universal floor for bath rooms; the tile is laid over a 3-inch grouting of cement. The floor joists which support this floor are spaced 12 inches on centers in order to support the additional weight of the floor. These are beveled off at the top at an angle of 45 degrees and a false wood floor is then

laid between the joists, two inches below the top; this is filled with a cement grouting over which the tile is laid. The only objection to a tile floor is that every mark shows upon them, making it necessary to be continually wiping it up to keep in sightly condition.

The kitchen floor should be recessed and covered with linoleum. It will last for years and even at a good price per yard is cheaper than the continual outlay for oil, varnish or shellac and workmanship necessary for a wood surface. The saving in household labor cannot be estimated.

Maple is often used in the kitchen or bath or such floors that are to be scrubbed. It is very light in color, hard and durable and is less expensive than oak.

Oak, on account of expense, is confined usually to the lower floor. Hardwoods come in narrow strips and are less liable to open cracks than the wider run. Very thin flooring may become loose and rattle when walked upon.

Care should be used in laying floors to have a level underfloor laid diagonally as a foundation. Flooring laid in the same direction as the underfloor will open up at the joints between the boards below in winter and hump up over each joint in summer, even if it was originally delivered well kiln dried. Hardwood flooring comes end tongue and grooved and with nail holes, making it possible to produce a good floor with care in laying. White pine floors are used very little, quarter sawed hard pine and vertical grained fir being used as substitutes. Birch is used extensively for floors, and some beech is also used.

No finish or flooring should be delivered that has not been thoroughly kiln dried, and then only after the plastering is entirely dry.

The finish floors should not be laid till all plastering is done and interior woodwork in place.

Interior Finish and Kinds of Materials

MANY examples of stock designs are now obtainable, and for the average house of moderate cost are very acceptable. The architect will recommend what is suitable for the house he has designed.

A wood that is to be finished natural or stained to bring out the beauty of the grain, will be best with few mouldings. If, however, the finish is to be painted, mouldings in correct architectural style should be carefully followed, for each curve and projection will receive its full value in the even color of the paint.

Special finish, such as beams, columns, seats, mantels, sideboards, etc., should be carefully considered in relation to the finish of the doors and windows and with each other, that all may be in harmony. Do not use more than one variety of wood in a room unless upon advice of a capable designer. Mahogany finished doors are sometimes used, with white enamel, or flat toned white, with mahogany furniture.

Woods For Interior Finish.

Finishing woods should be in harmony with the thought and tradition of the rooms in which they are used. The use and furniture of the room are deciding factors. In like manner the finish that is put upon it should be in harmony with the contents. Some woods are best adapted to stain, others to paint, and some can be treated with either. The effect produced in one wood by a given stain is not necessarily similar in another wood. Special treatment is required in each case.

The woods most in use are oak, mahogany, birch,

walnut, maple, southern pine, white pine, white wood, fir, cypress and some redwood.

Among other woods may be mentioned chestnut, ash, cherry, gum, sycamore, and spruce, but those preceding are most in evidence.

Oak.

White and red oaks are used for interior woodwork, furniture and floors and are either straight or quarter-sawed, the latter bringing out the beautiful flaky effects so familiar to all.

Oak is open grained and when a rubbed or polished surface is required must first be filled and then receive the various coats of varnish.

When a mission or wax finish is wanted, no filler is used. For a natural finish a transparent filler is used without stain. Oak stained finishes are known as fumed oak (a rich brown, light in tone), Old English oak (a medium tone of rich brown), cathedral oak (a dark reddish brown), early English oak (weathered brown in medium tones), and silver gray (light silvery effect). Any of the above methods may be used for finishing these stains.

Owing to the presence of gallic acid in oak woods the stain used should be scientifically manufactured to resist it.

Birch.

This is a very popular wood of light reddish brown color and close grain which requires no filling. It is finished natural or may be stained walnut, cherry or mahogany. No better surface is known for white enamel. It is less expensive than oak and makes a good floor.

Fir.

This wood has a close grain which does not require filling and takes stain beautifully. It resembles spruce and pine in appearance and structural qualities and is

largely used for interior work. The markings or slashes of the grain range from very fine to very coarse or may be had perfectly fine and straight. The light and dark portions are in beautiful contrast and harmony and is best with a dull finish or wax. The wood should be thoroughly kiln dried, pitch pockets removed and any remaining pitch "killed" in the finishing, as it is likely to appear later upon the surface of the finish if not thus treated. For flooring it is extensively used both inside and out.

Cypress.

This is a very durable wood and while it has always been used outside has come into use for inside finish on account of the many beautiful stains which bring out the different variations of the grain.

Browns, such as Cathedral, Old English, Weathered and Fumed are very satisfactory. The grain is close and requires no filling. It makes a handsome room but the furniture should be of the same wood. Gum wood is stained in imitation.

Maple.

This wood is fine grained and of compact texture. Its fibre is sometimes distorted, producing "birds-eye," "blister," and "curly" effects. No filling is required and it is usually finished natural but good effects can be had in mahogany, cherry and silver gray. Floors of maple finished with good floor varnish are very durable.

Hard or Southern Pine.

The close, strongly marked grain of this wood does not require filling and is heavy, hard, strong and durable. It is much used for interior trim and shades of brown or silver gray stains are very effective. The mission finish adds much to these stains. A first coat of shellac should be applied when the wood is full of

pitch. While it may be used for white enamel, birch, whitewood or poplar will give better results.

Soft or White Pine.

This might be called the most common of our woods. It is light, straight grained and does not require filling. Light yellowish white in color, it is usually finished white but takes any stain readily and its beauty is surprising to one accustomed to associate it always with paint. White enamel may be placed upon it to advantage.

Whitewood, Poplar and Cottonwood.

These woods have similar characteristics and are used for interior woodwork. Whitewood is suitable for carving, but the chief use of these woods is for white enamel work.

Mahogany.

Mahogany is used sparingly for finish and sometimes in combination with painted or enameled wood as for hand rails or stairs with white enameled balusters. Both straight grained and crotch mahogany is used, the latter as a veneer on account of its high price. Mahogany takes a high polish or may be very attractive when the varnish is rubbed down to a dull finish. It is open grained and requires a paste filler. The beauty of its grain is unsurpassed and the wood is of a rich brown color.

Walnut.

This heavy, tough, beautiful, open grained wood requires filling. Its color varies from light to dark brown and is used mostly for furniture, but is getting very scarce.

Circassian walnut is different in color from the common black walnut and has beautiful markings.

Redwood.

A native of California, the tree is noted for its enormous size. Its color is reddish brown, it is of light weight and its grain is close, requiring no filling. Curly redwood is occasionally distortious of the grain and is used in costly interior decoration. Finished natural it is very beautiful, but is also well suited to stain. The wood should be thoroughly kiln dried for interior work. Externally it is much used for shingles.

Relative Hardness of Woods.

Taking shell-bark hickory as the highest standard of our forest trees, and calling that 100, other trees will compare with it for hardness as follows:

Shell-bark hickory	100	Yellow oak	60
Pignut hickory	96	White elm	58
White oak	84	Hard maple	56
White ash	77	Red cedar	56
Dogwood	75	Wild cherry	55
Scrub oak	73	Yellow pine	54
White hazel	72	Chestnut	52
Apple-tree	70	Yellow poplar	51
Red oak	69	Butternut	43
White beech	65	White birch	43
Black walnut	65	White pine	30
Black birch	62		

Millwork

Exterior and Interior.

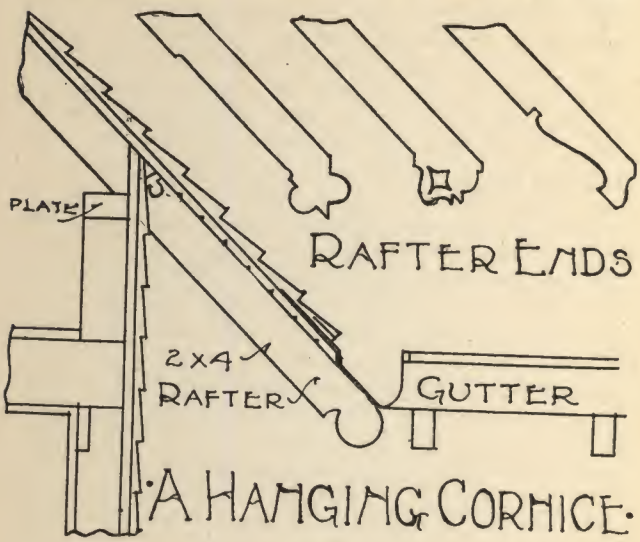
THE kind of cornice for any given house depends upon the architectural style employed. Some styles allow considerable liberty in details, while others such as the classic are very exacting, each moulding having a certain shape and definite proportion. The colonial architecture is properly classic in style, but has been modified in many details. The rafter construction of the hanging cornice shown in Fig. 10 is identical with that shown in Fig. 7-A describing the frame. The rafter end is cut as suggested in the several outlines of the drawing and is securely spiked to the plate. V joint sheathing is nailed face downward upon the rafter ends and can be seen from below. The gutter is shown attached to the end of the rafter and is drained by a lining properly pitched to down spouts. This is not shown and is not necessary for short lengths of level gutter. The shingles should be nailed with short nails to avoid driving through the V joint sheathing. Often the rafter end is set low enough to allow two thicknesses, one of V joint or beaded sheathing and one of common roof boards.

Several bungalow cornices are shown in projection from two to five feet, with and without gutters.

In Fig. 11 the rafter construction is similar to that shown in Fig. 7-B of the frame description. The under side or soffit of the cornice, as it is called, is produced by putting in "lookouts" to which the jointed sheathing is nailed. The crown mould and facia are constructed as shown, forming a V shaped gutter lined with tin. A gutter of this shape allows the ice to collect without damage from lateral pressure. The mould-

ings in the angle between the soffit and the house wall are ornamental in their uses and are called the bed mould. This cornice is suitable for a small house on conventional lines, somewhat colonial in character.

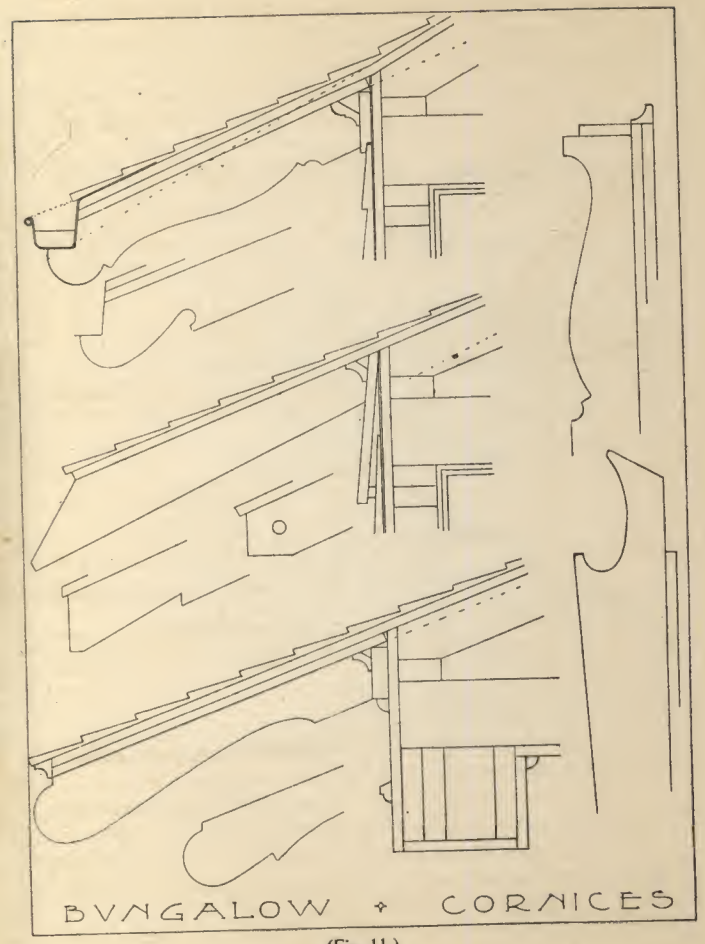
Fig. 13 shows a box cornice with frieze and architrave of the colonial type suitable for a house of good size.



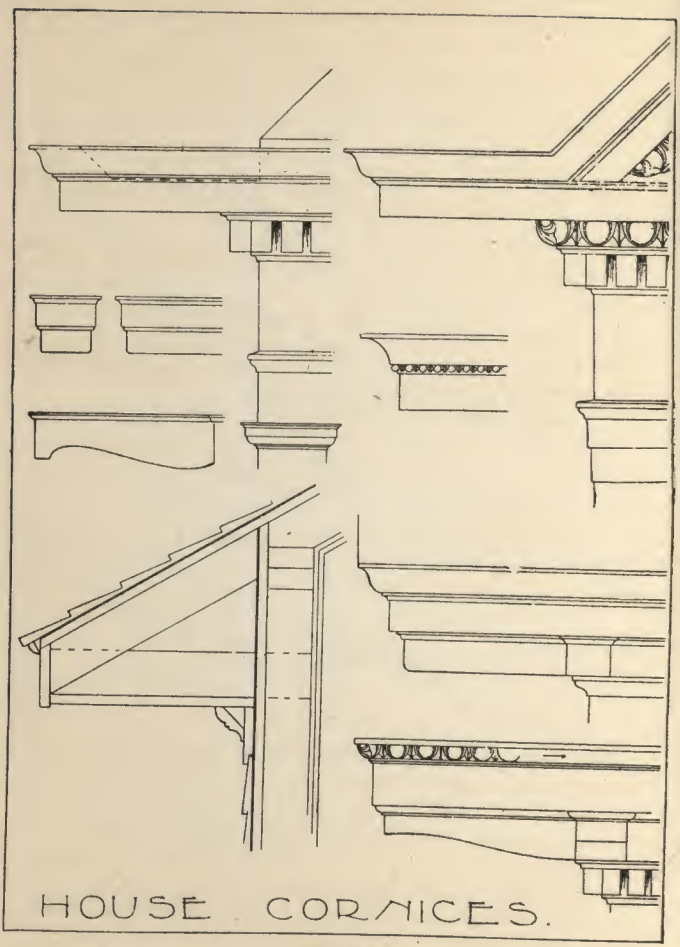
(Fig. 10.)

The roof is provided with an easement just before reaching the gutter, the rafter being raised up to change the direction of the roof line. The construction is very similar to that in Fig. 11, but provides a larger gutter. Note that no water can run over the face of the crown mould because the board at its top edge is pitched back toward the gutter.

The soffit is provided with jointed ceiling and brackets are shown in addition to the bed mould. The frieze,

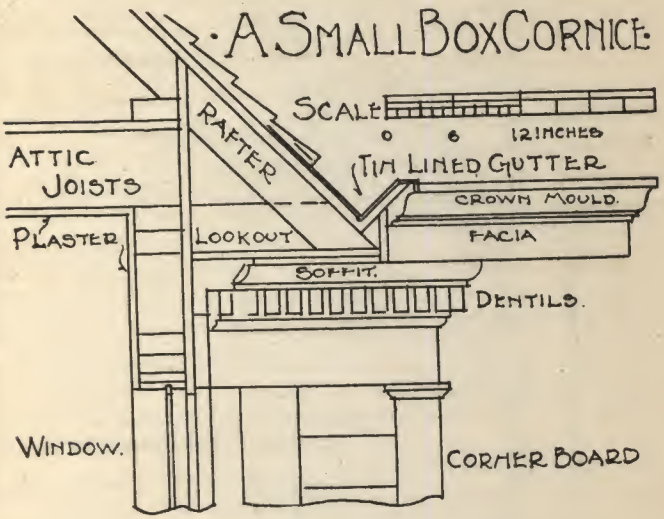


(Fig. 11.)



(Fig. 12.)

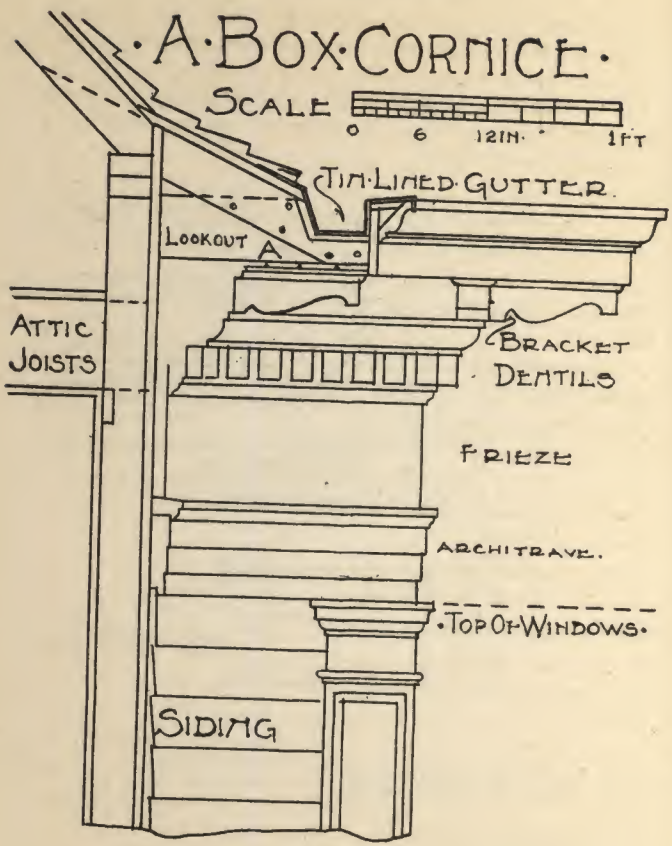
architrave and cap of the pilaster or corner board is shown. On a brick or masonry house the face would be the same as that indicated by the siding. The gutters should all be constructed to properly drain. Some details of simple house cornices are shown which will produce good effects.



(Fig. 13.)

The porch cornice is usually constructed on the same general lines as the main cornice although the cornice mouldings and in fact the whole entablature is somewhat lighter.

The details shown in Figure 15 are Colonial in character and are often seen in residence architecture. Usage rather than purity of architectural style is indicated, the latter being left to more technical works upon the subject. The entablature with its architrave, frieze and cornice is outlined showing the various



(Fig. 14.)

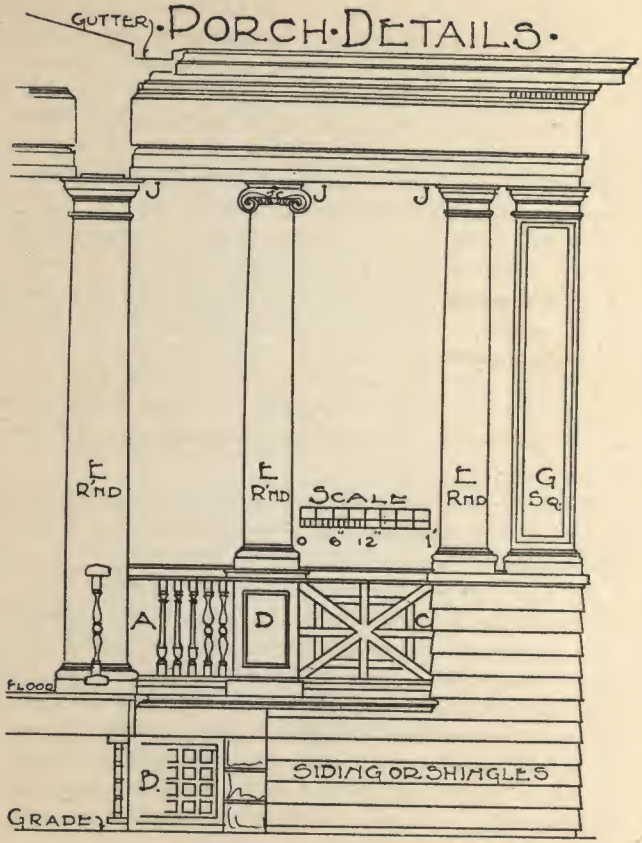
mouldings and the gutter. The columns are shown in different sizes and arrangements. Those lettered E are round and the pier G is square with paneled sides. The larger column starts from the floor and the balustrade is cut between. The remaining columns and

the pier start at the top of the balustrade. D is a pedestal that may properly be used to support the column while at C the sidings or shingles are carried up to the top of the rail. The "filling" between the upper and lower rails of the balustrade shown at C is to be repeated to fill any given stretch of rail between columns and if not too coarse and open makes a very good composition. The balusters shown at A are in two styles spaced about two-thirds of their width apart. On cheap houses, balusters are usually too far apart. Their exact outline and detail is best left to the architect who will produce a better effect in all these items if allowed to use the judgment which his education has made possible. At B is shown a simple lattice effect as a filling beneath the porch. Three courses of stone are shown adjoining supporting the pedestal and column while at the right the siding or shingles are indicated, carried to the grade line, finishing upon a footing of cement or stone.

Foundations under columns, piers or steps, should be carried below frost except in very porous soil where the dampness drains away quickly.

At J are shown the capitols of the columns. That in the center is Ionic, the others being Doric. Unless of a very plain character, capitols are best purchased from dealers in composition ornaments, because of the excellence of their modeling and moderate cost. Almost any conceivable design can be obtained, making it especially important that the selection be made by a person understanding design. Bungalow cornices may be used to advantage about the porch if the rest of the house is in keeping.

These are a few of the methods of treating porches. Instead of the column and pier, E and G, the siding might be carried up to the top or brick might be used.

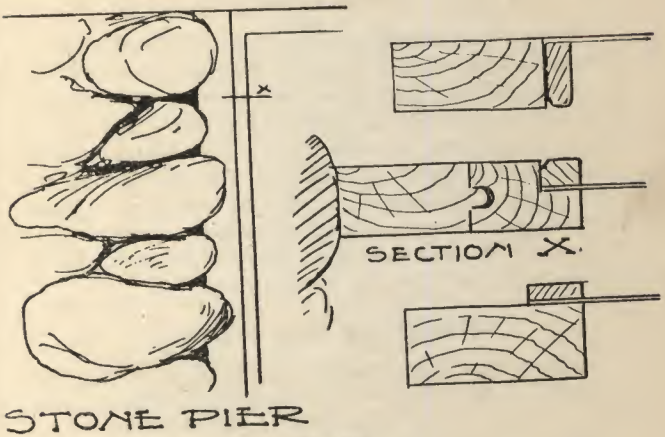

GUTTER
PORCH DETAILS
J
J
J
E
RND
E
RND
SCALE
0 6" 12" 1'
E
RND
G
SQ
A
D
C
FLOOR
B
SIDING OR SHINGLES
GRADE

(Fig. 15.)

Screening the Porch.

If the porch is built up with rectangular openings as is the case when brick or cement piers are carried up, the problem of screens is an easy one. The screens are set in a simple frame to fit the openings.

Where columns are used the mistake is often made of putting the screen outside the columns. The columns, expensive in themselves, are obscured and might



(Fig. 16.)

better have been simple posts if the screen is to be outside.

The screen should be placed between the columns from the soffit to the top of the top rail. A smaller screen is placed behind the balusters and below the bottom rail is a small filler of wood containing small holes at intervals to provide for drainage.

To screen an opening built up with cobble stones take a piece of dressed and matched fencing wide enough, and cut it to fit the indentations between the stones. Retain the tongue on the edge toward the

frame of the screen in which is plowed a groove to receive the tongue as at section X (Fig. 16).

If the indentations between the stones are very deep the fencing may be only partially fitted and the remaining space neatly filled with cement, using the board as a guide to the trowel on each side. The cut shows the stone pier and three methods of attaching the wire to the frame.

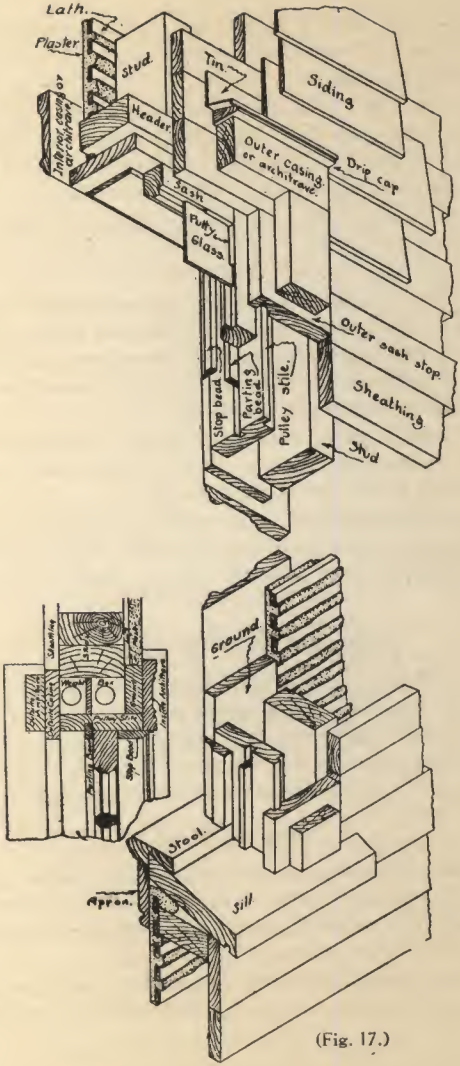
Wire Screen.

The best wire cloth to use is made of galvanized wire. It costs a little more than black painted wire cloth but is almost entirely rust proof and lasts so much longer that it is cheaper in the end. The greatest width is 52 inches but 48-inch is easier to get. Uprights should be just as few as good construction will permit that the view may be obstructed as little as possible. Copper wire is used but its cost is prohibitive. Full length screens for windows are best because the sash can be placed in any position for ventilation.

Window and Door Frames.

Window and door frames should be correctly and carefully made, for it is here that cold finds its way into the house rather than through the walls.

Figure 17, of frame construction, shows the sash, stops, frame, inner and outer casings and all the adjacent construction, such as plaster, studding, sheathing and siding, all carefully marked. Note the little tongue on the "pulley style," which fits into the "outer sash stop." This makes a tight joint, keeping the cold out of the weight box, the space between the "pulley style" and the first stud. It is often the absence of this tongue that makes a current of cold air noticeable at the pulleys. The "outer sash stop" should always be wide enough to nail to the first stud and the building paper which covers all the exterior sheathing should be


Lath.
Plaster
Stud.
Tin.
Siding
Header
Inside casing or architrave
Outer Casing or architrave.
Drip cap
Sash
Putty
Glass
Outer sash stop
Parting bead
Pulley stile.
Slop bead
Sheathing
Stud
Ground
Stool.
Apron.
Sill

(Fig. 17.)

carried well over it under the "outer casing." Note the "drip cap" with the protecting tin over it turned up under the siding.

The "ground" is shown forming the inner side of the weight box, extending over to the stud and making a tight joint with the plaster. The inside casing covers the "ground" and extends over on the plaster.

Figure 18 shows the box frame adapted to walls built of various materials. For stucco veneer, note that the only difference is that furring strips are nailed eight inches on centers directly to the sheathing over the building paper, on which to nail the metal lath. A small moulding must be placed about all outside casings, either door or window, to provide for the extra thickness of the stucco finishing coat.

For brick veneer, staff beads take the place of the outside casing, as shown. It is made to receive the storm sash or screen 1⅛ inches thick.

For cement blocks, solid brick or hollow tile construction, the staff bead is the same, but the back of the weight box is covered with a board to exclude mortar.

Basement Window Frames.

Figure 19 shows the construction of an ordinary plank basement window frame, rabbeted on the inside for a 1⅜-inch sash, hinged at top. The outside is rabbeted 1⅛ inches to receive the screen or storm sash. A small "staff bead" makes a finish against the masonry.

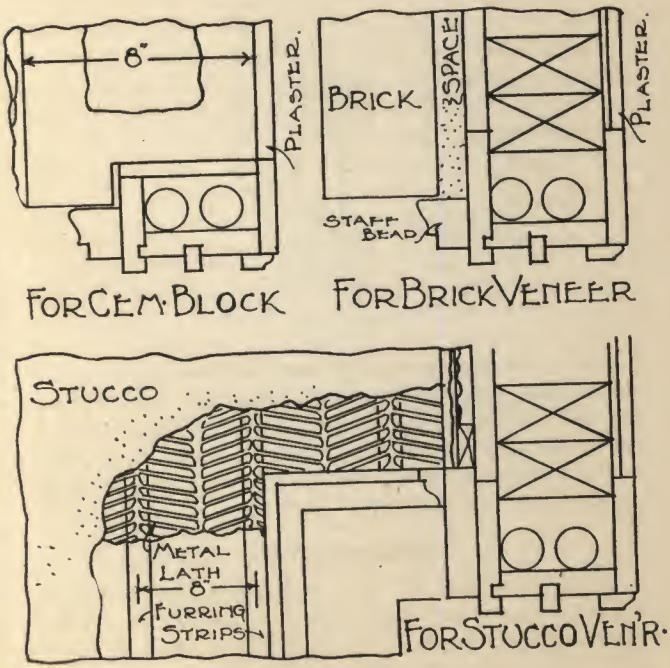
Hanging Sash.

The sash should be carefully balanced with iron or lead weights, and hung with the best of sash cord. Sash balances in place of weights are often used, but they are more expensive.

The sash should be primed as soon as fitted, so as to avoid swelling from moisture, which would cause them

to stick; the pulley stiles it is generally advisable to simply oil. These should preferably be made of hard pine. It is sometimes wise to paint the stile of the upper sash so as to conform with the painting of the balance of the exterior frame.

While upon the subject of sash, it might be said that they should be glazed at least two weeks before being brought to the building, to allow the putty to harden well before sash are handled.

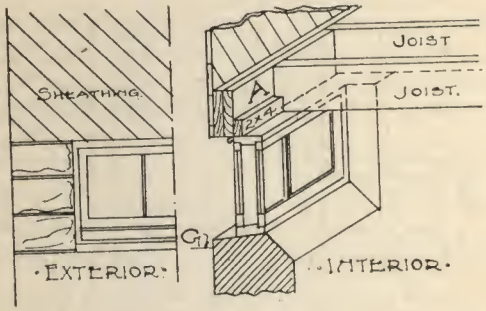


(Fig. 18.)

Exterior Door Jambs.

Figure 20 shows an outside door jamb at the right for frame construction. The inner edge of the jamb is rabbeted for the door, either 1¾ or 1⅜ inches. The rabbet for the screen and storm door is formed by the "outside casing," 1⅛ inches thick.

Double studs are carried around all openings as shown. The door sill is best of oak of the pattern indicated, with a pitch outward to shed moisture.



(Fig. 19.)

This jamb may be readily used in masonry by placing a staff bead same as that used for the window frames, instead of the outside casing. Some nail the staff bead directly on the casing which is made narrower, because when the masonry is built up around it, an absolutely air-tight job is secured.

Interior Millwork.

There is nothing about a new house that will give the owner more satisfaction than nice millwork. If the interior finish of your house is well smoothed, keeps its shape, all joints tight and nicely fitted, it is easy to keep clean, and always satisfactory. On the other hand, there is nothing about the house that is more

annoying than poor interior finish, of rough materials, open joints and casings warped from the walls.

Begin superintending your millwork by being careful to buy it of a good responsible firm. If you buy it yourself, get estimates only from such parties as you know will do good work. On getting your estimate, check it over with the plans, being very careful to see that everything is in that you will want in the way of millwork. This will necessitate a few hours' careful work on your part, but besides giving you the satisfaction of knowing what you are going to buy, it will also help to familiarize you with each little detail of your plans, and you can judge for yourself whether you wish to make any changes in the arrangement or size of windows, doors, etc. Now is the time to make changes, if ever, not after the work is under way. You will also find whether the firm you wish to deal with has made you a thorough and complete estimate.

Remember that while one of your objects is to buy this millwork as cheaply as possible, your main object is to have it well done, as it will only be done once for this particular house. You are buying something that you probably will not see until it arrives at the building to be put in place, and you will have to trust largely to the firm that executes the work. Of course, you may say, there are the specifications, they will have to follow them; but what are you going to do about it if the specifications are not strictly followed? The only thing left is to insist on their replacing the work, which is generally unsatisfactory on account of the delay it causes, and is unpleasant, as well, to all parties concerned.

If you let it with the general contract, insist on the contractor buying it of good parties, even if you have to add a few dollars to his contract. Any reliable and responsible contractor, however, will buy of the best

people, as he knows it is for his interest as well as yours to have the work satisfactory.

When your millwork is received check it up carefully with the invoice that will accompany it, or have your foreman do so; for if there is to be any claim made for shortage or other reasons, it is better to make it as soon as possible, as it can be more easily traced and will be more satisfactory to all concerned if attended to promptly.

Regarding preparing and shipping the materials. All first-class mills hand-smooth all face surfaces of hardwood finish or pine for natural finish, and for the best of work, surfaces that are to be painted. If this latter is desired it should be specially specified.

All frames, if shipped out, are fitted together and each tied in a separate bundle; doors crated and protected against scratching in shipment; casings cut to lengths and tied in bundles, and mouldings tied in bundles with back surfaces exposed. It is necessary to use the utmost care in shipping this material, and even then, it is liable to get some scratches that the carpenter will have to fix up when he puts the work in place.

Regarding quality, all hardwood or natural finish work should be free from knots or other defects on the face surface. For first quality of pine work for painting, such as is generally used for second story finish, the doors should be clear stock; no knots or dark sap, and the remainder of the finish with only a few such slight defects as will cover usually with two coats of paint.

In making stairs the mill man should furnish a sketch carefully laid out in accordance with the architect's drawing, which will enable your carpenter to put in his rough work before plastering and have it in shape so finish work will fit. This finish stair work should come all smoothed, and in the case of main stairs the treads and risers should be carefully housed in strings and

ready to go together. See detail and description of stairs.

Such items as mantels and bookcases should be put up at the mill like cabinet work and all ready for the painters. All this material should be thoroughly seasoned and kiln dried before being worked. Otherwise it will not keep its place but will shrink and warp. This you have to depend upon the mill people to attend to, and as all mills are not fitted up properly to kiln dry material, this is another reason why you should be careful in selecting your mill firm.

When the millwork is received do not put it in place until the new building has thoroughly dried out. It should be kept in a dry place until the house is ready to receive it. Many a good mill job has been spoiled by being allowed to lie around where the material would gather dampness and by being fastened in place before the building has dried out.

While economy is usually kept in mind in building houses of moderate cost, and very pretty effects can be obtained with stains, etc., yet it is best to use hardwood finish in the main rooms of the first floor. The first cost is, of course, a little more, but it would be better to economize in furniture or something that can be replaced at any time and have this very prominent, permanent and practical feature of a house, right to start with.

Doors.

The fitting and hanging of doors is an important matter. In hanging doors it is always desirable to look them over, and if there is a spring either way, to hang the hollow side into the frame. These doors should be fitted so as to allow for about a sixteenth of an inch all round. The front edges should be beveled sufficiently to swing into the frame clear of the woodwork. The butts should be placed so as to swing doors out clear of the casing, plinth blocks, etc. It is customary

in hanging doors to place the top butt about eight inches down, and the bottom butt about ten inches up; and in first-class work to hang all doors with three butts in size from 4 x 4 to 5 x 5, according to the size of the doors. In all cases, doors 7 ft. 6 in. in height or over, should have three butts.

The locks should be let into the door and the striker into the jamb, so as to work easily without rubbing; and the knobs and escutcheons should not be put on until after the painting is finished, to prevent their being soiled with paint or varnish.

Doors will sometimes cause trouble by sticking. This is caused either by sagging in of the door, by settlement, or wearing of the hinges. In case a door has sagged badly the only remedy would be to make a new door, though it can be taken off the hinges, set up, wedged and glued. In case the hinges are worn, the only thing to do is to raise them on the jamb or lower them on the door. If the trouble arises from settlement, the raising or lowering of the striker will often remedy the matter.

Outside Doors.

Outside doors should be veneered in some hardwood. They should be about two inches thick and have a wash to prevent the water from blowing in under same; and it is usually desirable to provide a threshold for the vestibule door, if there is a vestibule in the house, as a close fit is desirable for this door on account of the cold. There should always be room for the come and go of the panels of doors, especially doors of one large panel. When the panel warps or the door splits apart at the joints, it is because the proper allowance has not been provided for the expansion of the panel. Use three strong hinges on outside doors, and two hinges for interior doors. Have your hardware in harmony with finish and design of entrance and other doors and windows.

Framing partitions and putting in the rough work for hanging sliding doors is a very important matter to look after. A sliding door requires a double partition. The studding is usually set flatways, leaving a space of about five inches for a pocket, which is built of 7/8-inch, or preferably, 5/8-inch matched lumber, nailed to both sides of the pocket and up to the under side of the track. Care should be exercised to see that the back side of the pocket is perfectly tight to prevent cold from entering; and the track should be fastened to the bottom edge of a 1 x 10 or 1 x 12 dry pine board, and then secured to a header between them.

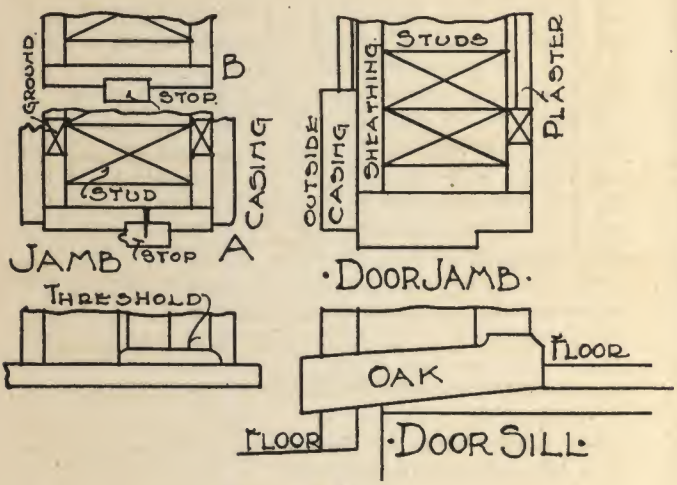
Where the track is fastened to the studding direct, in case of settlement, the track is thrown out of line, and always causes trouble with the door getting off the track or sticking, and never can be remedied without pulling off the plastering and track and resetting it. This is an expensive operation, but by securing the track in the manner described above, and fastening it to the stud by nailing in the bottom edges of the board, care being taken not to fasten these boards to the studding in the opening; in case of settlement, the tracks are not thrown out of line and the door is always in working order.

For sliding doors use door hangers that are held to the track and can not jump off.

Cased Openings.

The term cased opening refers more particularly to wide openings between rooms, but actually every door or window is a cased opening. In a well designed house the tops of all doors, windows and wide openings are kept upon the same horizontal line and the finish will be the same design for all in a given room if not throughout the story. This is a general statement as to the finish applying to very important work and must be allowed some latitude in a house of ordinary cost.

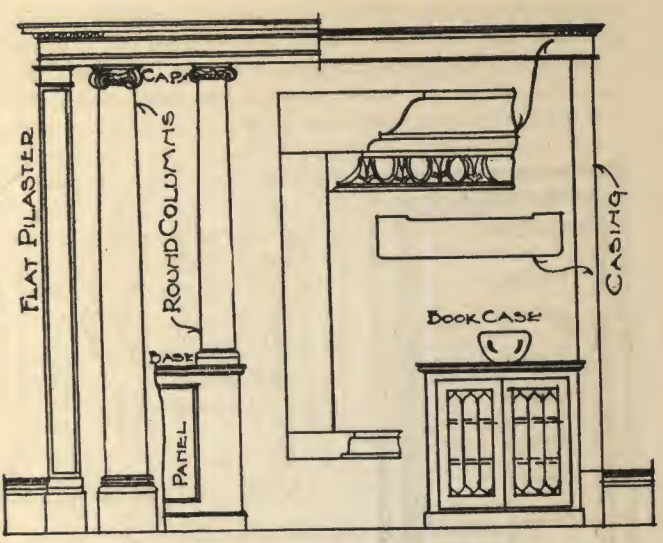
Figure 21 shows several methods of treating a wide opening such as might occur between hall and living room or living room and dining room. On the right is a simple casing with an entablature effect for the cap and a plain plinth and base mould, at the floor. This would make a dignified and effective trim for all the doors and windows.



(Fig. 20.)

Door Jambs.

At A, Figure 20, is shown the jamb of an ordinary interior door, with the "stop" glued and screwed in place and the casing on either side. Grounds are nailed to the stud before plastering to make a good nailing place for the finish. In many cases grounds are omitted and the stop is not plowed in, but simply nailed flat to the jamb. The threshold is shown in position, but is being used less every day for inside doors.



(Fig. 21.) Various Treatments of the Cased Opening with Details of Trim.

Pantry or Double Action Door Jambs.

The jamb of a pantry door to swing both ways is shown at B, Figure 20, and the stop from which the door is hung is indicated at the center. The finish is put on about the opening the same as for single action doors.

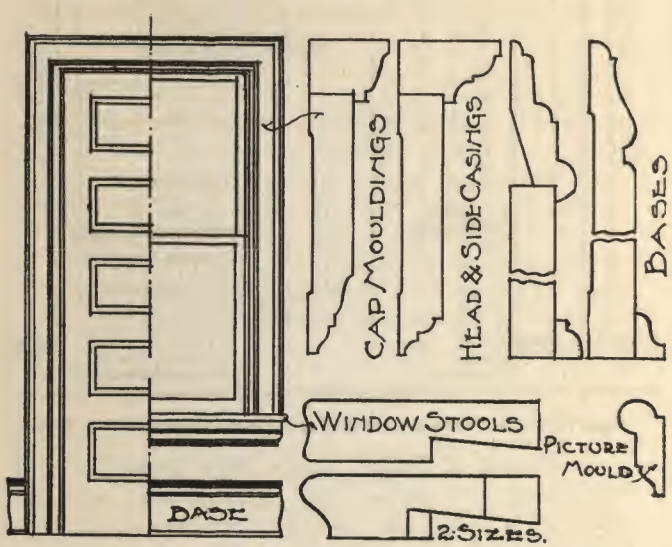
Double action doors are provided with special floor hinges and should have push plates on each side and if occasion demands it, also kick plates. A special device is provided to hold the door in position. A door check may be used in position when it is desirable to keep the door closed.

Casement and French Door Jambs.

In these jambs the construction does not differ from the ordinary exterior door jamb or that of the cellar

window jamb, in section. The sash is usually about 1⅛ inches in thickness and the rabbet must correspond.

In some cases special hinges are used which are always accompanied by a drawing, showing what the construction of the frame must be.



(Fig. 22.) Half Elevation of Door and Window with Details of Trim.

Figure 22 shows half elevations of a five-panel door and an ordinary two-part window, with trim of a different character from that in the previous figure. This would be very appropriate for a Colonial house.

These are of stock design and could be obtained anywhere or something very close to them.

Pantry Fixtures.

The arrangement of the pantry, its shelves, drawers, etc., and the arrangement of kitchen dresser depends

considerably upon the size and shape of the pantry and kitchen, each house presenting a different problem; but mostly the arrangements depend upon the requirements of the housekeeper. Each mistress of a home has her own ideas as to where she wants the chinaware, silver, table linen, kitchen utensils and food stuffs, and her wishes should prevail.

The first requirement should be convenience more than looks. If one prefers to do their pastry work in the pantry away from the heat of the kitchen, there should be provided flour bins to roll on rollers.

The flour in the bins should be easily accessible and the bins should be so made that they can be removed at pleasure for cleaning around them. The size of each bin depends somewhat upon the amount of flour it is desired to store at one time and the space in which they can be placed. As too much flour in the bins makes it hard to manage.

The lower part of the pantry fixtures should be divided into compartments and drawers to suit individual requirements. Some housekeepers would require in the pantry fixtures a place for the hash bowl, kneading board, and place for storing extension table boards.

Each pantry should have several broad drawers for table linen and small drawers for knives, forks, etc. The fronts of the drawers can be paneled for looks, but are kept clean easier when the front is one plain board rounded on the outward edges. All lumber in pantry fixtures should be perfectly smooth and dry, of white or yellow pine. In pretentious homes oak or birch is sometimes used for all exposed parts. Pantry shelves should be of seven-eighths boards. They are usually fixed in place but can be made adjustable. There should be from 10 to 12 inches distance between the shelves and each shelf should be from 12 to 14 inches wide.

While these dimensions for shelves are given, it is better to give the matter of shelves more study on each

problem (though it is seldom done). The wider the shelves are, the greater should be the space between them in order to be able to reach over and take out the dishes behind. It is best to make the lowest space above the counter about 18 or 20 inches high, for the platters often run as wide as eighteen inches and should be stood on edge on the counter top at the back; for this purpose a narrow strip should be run along the top of the counter near the back. When a till space is required for tall vases, pitchers, etc., it is a good plan to place a thin shelf about four inches wide and six inches from the top for tumblers. On the edge of this shelf can be placed a row of brass or nickel plated hooks on which to hang cups, cream pitchers, etc.

Pantry fixtures are sometimes stained and varnished, but are best painted. All pantry doors should swing both ways from the hinge. When the pantry fixtures are of pine and painted it is a good plan to swing the door to the dining room from the side. That will make the servant walk around it to enter as she swings it before her. In this way it acts as a screen. If the fixtures are painted or stained with some taste, this arrangement is not absolutely necessary. Fixtures if of oak or birch can be made to harmonize with the dining room in finish. If the latter they can be stained and varnished to look like mahogany. A pretty fixture is one that is stained green and varnished for the main case and doors, with a white enameled crown mould, counter board, shelves and lining.

Sideboards.

There is a considerable difference of opinion as to the usefulness of sideboards. Some housekeepers consider them indispensable, while others consider them as a useless expensive ornament. There is much to argue on both sides of the question, and the opinions of various housewives are usually based upon their own per-

sonal experience rather than general information on the subject.

Many sideboards are mere ornaments, having very little practical use, and costing considerable. Sideboards, however, can be made both practical and ornamental. To make them mere ornaments, or mere cupboards to use as a china closet, is an easy matter, but to combine both beauty and usefulness, presents many difficult problems, and should be left to the good judgment of the architect. Oftentimes the builder has already in his possession a sideboard and space is provided for this by building on a little lay or recess in which to place the fixture, otherwise, it is desirable to have one made up at the mill.

The Stairway.

The location of the stair depends somewhat upon the requirements of the family. If the house is sufficiently large to warrant a back stair the principal stair may be located without reference to the rear portion of the house.

Space Occupied by the Stair.

To figure the required space, begin with the height of the story, usually 9 feet. Add to this the actual thickness of the lining and finished floor, the ceiling plaster and the height of the usual 10-inch joists of the second floor, 12 inches, a total of 10 feet from the top of first floor to the top of second floor or 120 inches. Divide this by 7½ inches, which is an ordinary and comfortable height to rise at each step and the result is just 16 risers in a total rise of 10 feet.

Take the sum of 2 risers, equal to 15 inches, and subtract it from 25 inches, which is 10 inches. This will be a desirable width for the tread without the nosing. The sum of the tread and riser is 17½ inches and by subtracting any assumed riser of reasonable height

from this figure will give the proper relative size of the tread. The lower the rise is, the broader will be the step to obtain the most comfortable proportion for comfort.

There is always one less tread than riser. Therefore with 16 risers there will be 15 treads equal to 150 inches at 10 inches each, or 12 feet 6 inches. This means that a stair with a total rise of 10 feet, composed of 7½-inch risers and 10-inch treads, will have a total horizontal direction of 12 feet 6 inches. This much space is needed for the steps alone.

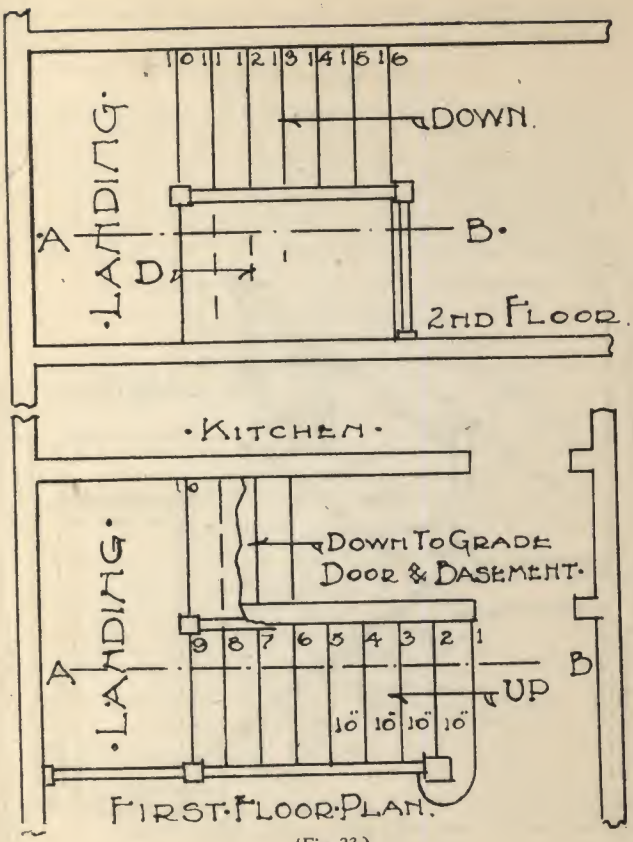
If landings are introduced the whole stair will occupy more space but the actual amount occupied by the steps themselves remains unchanged.

Headroom.

There should be at least 7 feet above the step where the floor comes nearest to the head in passing up or down. With the thickness of the joists, flooring and plaster added (equal to one foot) this means we must descend 8 feet, equal to 13 risers, which at 7½ inches each will be 8 feet 1½ inches, a trifle over. Only 12 treads will be required for this distance, equal to 10 feet at 10 inches each. Apply this by measuring 10 feet from the top riser of the stair, back in a horizontal direction level with the second floor. At this point the stair well, as it is called, can be floored over, but anything short of 10 feet will mean less than 7 feet in the clear for head room.

If a landing occurs before 13 risers have been counted walk across the landing and add the remainder of the 10 feet to the distance measuring from the first riser below the landing. The landing cannot be counted in the distance traveled because it is level and no progress is made downward.

Note on the First Floor Plan, Fig. 23, of stair that 10 risers are figured up and 3 risers going down to



(Fig. 23.)

grade are equal to a total of 13 risers, necessary for 7 feet head-room with this rise and run of stair.

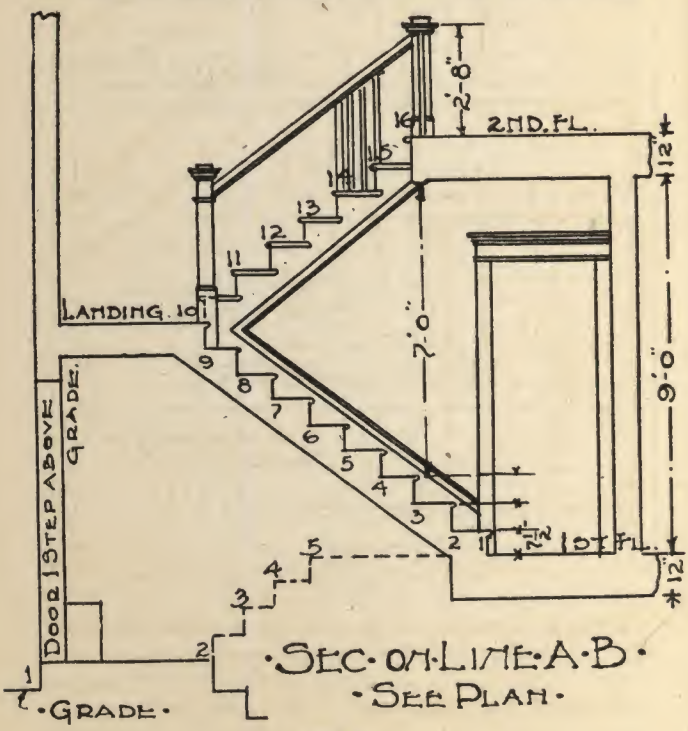
The section on line A-B, Fig. 24, shows the basement stair starting at grade, with 1 step outside and continuing up 4 steps inside of the first floor level. Each riser

of 7½ inches is marked with a figure from 1 to 16, inclusive, from first to second floor.

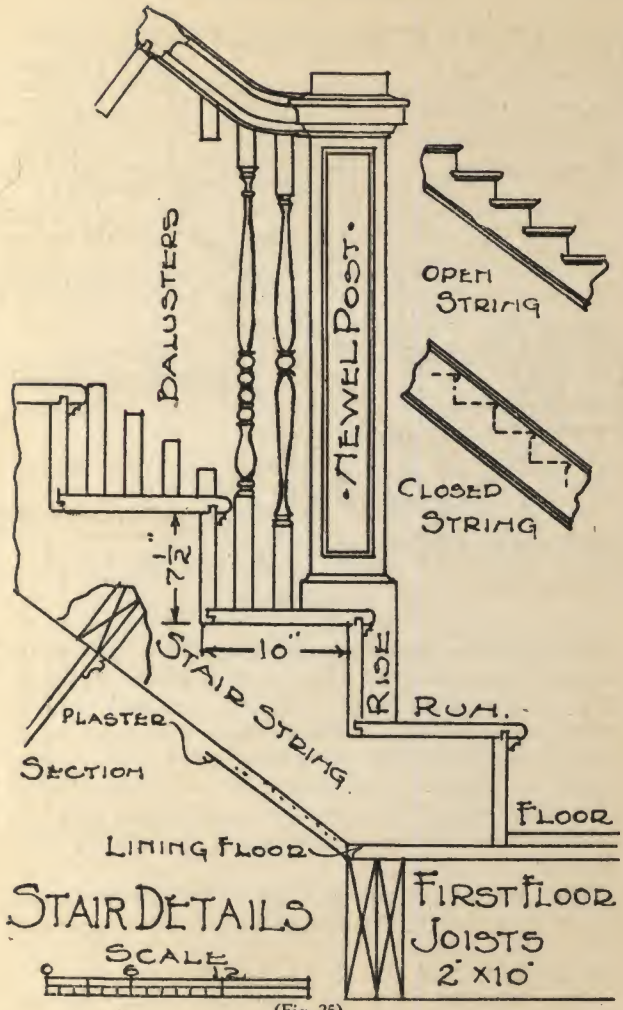
Construction Details.

The drawing (Fig. 25) marked Stair Details shows 2 joists at first floor supporting the stair string. This doubling of joists about openings in the floor was explained and illustrated in the article upon framing.

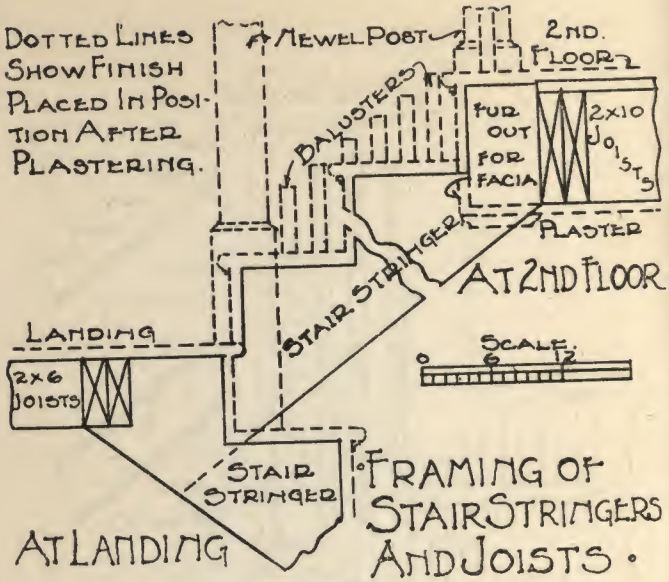
The string is cut from a 2 in. by 12 in. plank, 10 inches for the run and 7½ inches for the rise in this case.



(Fig. 24.)


BALUSTERS
NEWEL POST.
OPEN STRING
CLOSED STRING
7½"
10"
STAIR STRING
RISE
RUN.
PLASTER
SECTION
FLOOR
LINING FLOOR
STAIR DETAILS
SCALE
6
12
FIRST FLOOR JOISTS 2"X10"

(Fig. 25).



(Fig. 26.)

Sometimes the triangular blocks that are cut out are nailed in position upon a 2 in. by 6 in. plank, thus making another string. This should be carefully done to bring properly into line and avoid a creaking stair. Strings should not be set much over one foot apart. Note the shape of the string at its connection with first floor (Fig. 25), landing and second floor (Fig. 26) as illustrated. Strings should be set true and carefully nailed.

The finished tread and risers are tongued and grooved as shown, the nosing is made upon the tread with a cove beneath, in the angle with the riser, and the whole is glued, nailed and screwed together.

The finished string may be made either open or

closed as illustrated and the treads and risers are "housed" into it.

The newel posts should be placed securely in position, the stiffness depending so much upon them. The newel at the foot of the sair is usually larger and more ornamental than the others.

The rail should be of a pattern to easily fit the hand and should be 2 feet 6 inches above the nosing of each step, measured straight up to the top of the rail. Where the rail runs level it should be 2 feet 8 inches above the landing or floor to top of rail. Union with newels must be made by curving the rail in many cases, to give a pleasing line and avoid abrupt and awkward intersections.

Balusters are usually used for filling and may be turned or square. Note that the facia about the stairwell at second floor has been furred out to bring it in line with the top riser. This makes it possible to start the newel post upon the floor instead of having it project below the ceiling, with a turned "drop" as it would do if the facia were placed against the doubled joists. This is a neater method and could also be accomplished by placing the newel back in line with the joists, but would require an extra curve in the rail. The balusters for level rail will be a little longer owing to extra height.

Many fillings are used other than balusters and quaint effects are obtained which are very pleasing.

Stock stair details should be intelligently selected. If the house is in a certain architectural style, the stair should be in the same style. Wainscoting should be carried up the stair if it is provided in the hall, to get the best effect, though often it may be stopped at the first landing if economy demands it.

Miscellaneous Millwork

Wire Screens.

THESE are almost essential in every section of the country. The ordinary best grade of woven wire screen, generally painted black or dark bottle green, is sufficient for every purpose, except the very finest grade of work. In this case, it is desirable to use a specially fine screen, manufactured for the purpose, set in a metal frame and sliding upon a metal groove.

Copper screens last longer, but are more expensive. The wooden frames are, however, more economical and give very satisfactory service. It is preferable to cover the entire window with the screen, so that the window may be lowered from the top or raised from the bottom, regardless.

In case of French windows coming to the floor, the window screen should be hinged to swing as a door. In other cases, the window screens are best and most economically fastened by small iron buttons, four to a window.

Storm Sash.

Storm sash are only required in the more Northern states where the winters are severe and prolonged. They should fit over the entire window and be fastened the same as the wire screens are fastened in the summer.

When used, at least one window in each room should be hinged at the top, so that it may be opened for airing the room and for ventilation. If hinged at the top, long hooks should be provided to hold same in place, both when open and shut.

Blinds and Shutters.

These are still considered quite essential in most sections of the South. You see them quite commonly used still in the New England states, but in the West and Northwest they are growing more and more rare. The Colonial house, with its green blinds, is very attractive, but awnings and double shades are rapidly supplanting blinds and shutters.

In the first place, it is difficult to operate blinds when the window is covered with a screen, unless a special fastening be purchased for that purpose. Slight misuse will put them out of repair, and nothing is so discreditable to the appearance of a house as a blind half off its hinges.

Inside blinds interfere so with draperies that shades have almost entirely supplanted them, and the old cumbersome method of hanging draperies to a wide shelf over windows, so as to offer an opportunity to open blinds, has become almost obsolete.

Closet Shelving.

Specifications should provide that the closet shelving desired should be placed in all closets, with hook strips and hooks. If hanging room is desirable in a closet, do not destroy it by putting in two or three shelves. As a general rule, one shelf is all that is practicable in a wardrobe closet, as after allowing the space for hanging, the shelf is up so high the average person cannot reach it without getting on a chair. The shelf would be raised about four inches above the top of the hook strip, so that wearing apparel may be put on and taken off hooks without difficulty. A pole fastened up in the closet two or three inches below the shelf is a great convenience, especially where wearing apparel is hung on coat hangers.

Linen closets, medicine closets, soap cupboards, etc.,

should be fitted up with special shelving as individual requirements may designate.

It is also a good plan to place a six-inch shelf over the kitchen sink. It will be found exceedingly convenient for several articles it is desirable to keep off the drip board and convenient to the sink.

Clothes Chute.

One of the most convenient and step-saving devices in our modern home today is the clothes chute and no housewife after she has been accustomed to one of these, will ever do without it.

These should extend from the second floor to the basement and located at some convenient point either in the floor of the second story hall by a trap door or built in the linen closet or bath room and where possible, to empty into a soiled clothes basket in the laundry.

A 12-inch round galvanized iron pipe is sometimes used for this purpose or in some cases, these are built up of dressed and matched boards and are about 14 inches square. A small door opening into same should also be provided in the first floor.

Beam Ceiling.

Ceiling Beams are used quite extensively, and where properly detailed add considerable to the attractiveness of the room.

These are not solid beams but are built up of ¾-inch or ⅞-inch boards which are nailed to grounds which have been nailed to the joists for that purpose before the plastering is done.

Oftentimes a one-half beam only is used. This is placed up in the angle of wall and ceiling and the picture mould is then used to form the lower member of this beam.

Paneled Wainscoting.

The walls that are to receive panel work should be thoroughly grounded, as before specified, and the panel work should be nailed at the bottom under the case and at the top under the cap, securely to the studding or grounds, and usually in first-class work be housed under the plinth blocks and dadoed together at the angles. Then the cap and base nailed on with small round headed finishing nails, in the least exposed places.

Ornamental Cornices.

These really come under the supervision of the decorator.

A very economical and quite ornamental cornice for a room can be made out of 2x8 pine plank. The shape of the moulding is quite important and should have the regular cornice form. The main difficulty with this is that it makes a rather heavy moulding to mitre satisfactorily on corners and scribe to the plaster on the ceiling, which generally will show a slight unevenness. For these reasons it is, perhaps, better to make the cornice in three or four members, using smaller mouldings, though this adds slightly to the cost.

The best material is plaster of Paris, or Keens cement and this is not much more expensive than the wood, if ornamentation is omitted. Should the design, however, call for dentil work or carved courses, the cost will be considerably increased in either wood or plaster; and in this case, plaster should have the preference, giving the best effect for the least money. Such a cornice certainly does very much to enrich a room, and is money well expended.

Ornamental center pieces, if used at all, should be of plaster of Paris.

Finish Hardware

THE hardware is but a very small item in the whole cost of a building, even if the very best is used; the difference between good locks and poor locks is so little that it is hardly a saving to use poor locks. After a lock is mortised into the door it is out of sight excepting the face, and that is often painted over.

Because the work is so easily concealed poor locks are often used to save a few cents, and the discomfort has to be borne by the occupants of the house day after day, until the lock breaks down or some of its badly constructed parts give way.

A new lock then has to be put in at a greater expense than an easy spring lock would have cost originnally, and the finished door is marred by the unavoidable soiling of the woodwork. Outside doors at least should have good locks, for they will not only last as long as the house stands, but they are secure against intrusion, and will always give comfort in using.

The "easy spring" which is applied to all good locks enables the latch bolt to work very freely, so that the door does not have to be slammed, nor stand ajar, but latches gently as it is closed. This is accomplished by using a good stiff spiral spring with a long leverage for the latch bolt and a direct pull for the knob, thus producing the desirable combination of "easy" on the latch bolt, "firm" on the knob. It has great durability, there is nothing to get out of order.

Inside locks and front door locks are made with the easy spring principle, and it is also applied to cylinder locks, which have the small grooved flat keys.

Great care should be used in adjusting and putting in place cylinder locks. Often a mechanic inexperienced

with cylinder locks will attempt to remove the cylinder by forcing instead of removing the little set screw, the head of which always appears on the fact of the cylinder lock. This should always be turned to the left and drawn out before attempting to remove the cylinder, either to put it in place or to take it out of place, as when this is removed the cylinder readily and easily fits and you can turn it with the thumb and finger.

Cylinder locks give the greatest security possible, as the keys are made so that they have to raise at least five or six pin tumblers, which it is almost impossible to do with anything but the original key. They are made in such an enormous number of changes that there is rarely a duplicate.

While bronze plated butts in a great many instances are equal to real bronze, costing a good deal more money, they answer the same purpose and will often wear longer. This, however, does not apply to knobs which come in contact with the hand daily. Knobs should rarely be used excepting in genuine bronze or other metal to be durable and look well; in fact, a jet or porcelain knob is preferable to the imitation bronze plated knob on iron. It is a good plan to put on door and window stops by using ornamental screws and washers.

Colonial, Mission and other architectural styles should each be trimmed with the hardware that belongs to their style to be harmonious. Different finishes may be had in the same design and it is likely that an imitation may be bought instead of the genuine metal if care is not taken. Steel finished to imitate bronze brown, etc., will always cling to a magnet and this simple test may be applied by anyone.

Hinges, or butts, as they are called, are made with solid or loose pins and the better grades are ball bearing.

When a door opens out the loose pin butts should

not be used because removal of the pins would allow the door to be opened from the outside.

For small doors to bookcases china cupboards, etc., hinges are of the simplest design but are best with loose pins.

Swing sash, French windows, may have turn buckles, spring catches, etc.

For these windows which may be classed with the casement variety, special provision is made by manufacturers to swing them in or out and lock them in position, all operated from the inside. These devices render them water tight, a defect which has long been charged against casement windows.

For ordinary two-part windows, are provided special sash locks, and locking devices which hold the sash firmly in any position up or down. Sash lifts may be mortised or simply screened to the face of the sash. Weights may be discarded by the use of sash balances or friction devices. The window should be well protected by hardware of good quality, for it is there that entrance is often made.

Storm sash, screens, or shutters may be operated from the inside without raising the window. Storm sash and screens are hung on identical hangers, and a very careful selection should be made, getting a pattern that will allow the sash or screen to be placed in position easily. Often times they are put on from within and an easy hanger will be appreciated by anyone trying to hang the sash.

Sliding door hangers are made in many patterns and few things are more annoying than one that operates imperfectly.

The Plumbing

THE main work for both plumbing and heating systems must be "roughed in," as it is termed, before any plastering is done.

Sanitary Methods, Fixtures and Piping.

The plumbing system of the house consists of the necessary fixtures, their water supply, drainage and ventilation. Sewage is disposed of by sewer or by cesspool or septic tank. Septic tanks are constructed under patents controlled by certain manufacturers who furnish compblete information as to their operation. Cesspools may be constructed by anyone and of various materials. Cement is used in which two components are made, in one of which the solids are retained and from the other the liquids flow away into the soil. The solid must be removed from this style as necessity requires.

Another method consists in laying up a dry wall of stone through which the liquids escape, and requires cleaning very seldom if of a reasonable size in a porous soil.

The vast majority of cesspools constructed are of wooden plank, notched at the corners to hold without nailing. A few planks are put in position at a time and the earth removed, allowing them to sink into the hole. More planks are added until a walled up hole twenty feet deep is constructed.

In these forms of construction oftentimes no vent is installed, but might be put in to advantage if the climate is not too cold. A tree or fence is sometimes used to carry up and conceal a vent from such a place.

Sewer Pipes.

Glazed earthenware pipes, four inches or over, are used between the house and main sewer or cesspool connecting with the castiron drain pipe, from the interior, three feet outside the basement wall. All exterior joints between lengths of earthenware pipe and their connections with cast iron pipe is made with Portland cement, care being taken to produce a smooth joint inside.

Connections With Rainwater Leaders.

Rainwater leaders from the outside of the building should be at least three inches in diameter and be properly trapped before entering sewer or soil pipe. If connected inside the building, the pipe should be extra heavy cast iron, turned inside and outside with traps easy of access.

If the rainwater leaders connect with the main run of the sewer in basement on the house side of fixtures, all basement fixtures should have backwater valves on the branch runs, between these fixtures and the main run.

Soil Pipe Drains.

Four-inch extra heavy cast iron soil pipe should be used for inside drains and extending three feet outside of foundation walls, with a fall of not less than one-quarter inch per foot to sewer. All cast iron pipe and fittings should be thoroughly coated inside and outside with coal tar applied hot.

There should be a four-inch clean-out, with screw cap, at the foot of the vertical run and another near the outside wall, unless they would come within ten feet of each other, in which case only the latter is required. If the clean-out is below the floor it should be boxed.

The Bath Room.

The bath room should suggest sanitation the moment one sees it. The fixtures, floor and walls should be in harmony as to material and color scheme, that everything may look bright, clean and pleasing.

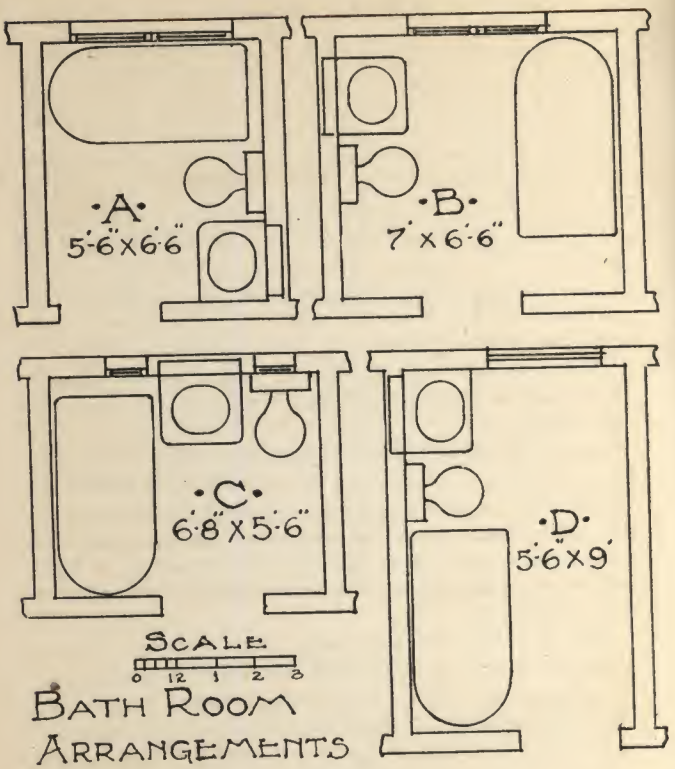
Size is a factor which enters largely into convenience, but is not essential to the above requirements. Plan A (Fig. 27) shows an arrangement about as small as it could possibly be, yet there is the required amount of space for the fixtures. The principal objection is the necessity of reaching over the bath tub to operate the window, which is a single sash to swing in, placed just above the wainscot cap.

Plan B is not open to this objection, as the fixtures are arranged at either side, leaving a free passage to the window.

Plan C is only 2 inches larger than Plan A, yet the arrangement of fixtures and windows is most admirable for its size. A small window is placed at each side of the wash bowl above the wainscot, lighting up both sides of the face when shaving and producing a light reflection in the mirror above the bowl in the door of the medicine cupboard.

Plan D shows the long bath room with the fixtures arranged along one side, with the wash bowl close to the window for light. This shape of room may result from the demands of more important rooms adjacent where the floor space is limited. Many prefer this type to any other.

Plan E (Fig. 28) shows a complete bath room of good size, but containing no more than the necessary space to contain the fixtures. The bath tub is shown here in front of the window, but the fixtures at either end make it possible to reach the sash with less difficulty than directly over the tub. The sitz bath is of great value in applying heat to the vital organs, concentrating the effect of increased circulation and correcting ab-



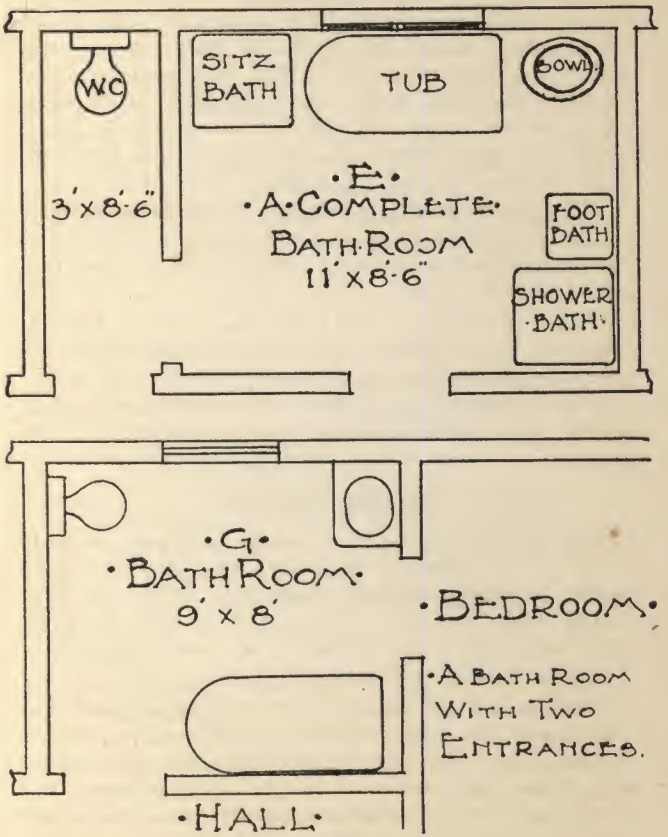
(Fig. 27.)

dominal ailments. A well appointed bath room should contain one. A pedestal bowl is indicated upon the plan, the most ornamental design of this fixture.

The shower bath is located in the corner and is provided with the various sprays at different levels for effects on the body and is enclosed with a protecting curtain.

The foot bath next to the shower bath is a convenience which may not be classed altogether as a luxury in a well appointed bath room.

The closet is isolated from the other fixtures, but may be approached through the door from the bath



(Fig. 28.)

room or from the hall. In this way it is handy to the bath room without being actually in it and is not put out of commission as far as the rest of the house is concerned by the presence of anyone in the bath room.

Plan G shows an arrangement which is found in some small homes, but which is open to some objection. It has two doors, one to the hall and the other to the adjoining bed room. The arrangement of fixtures is satisfactory, but the possibility of intrusion upon privacy is not. Where it is possible it is always well to arrange clothes closets or wardrobes about the bath room to deaden the sound to the adjacent chambers. In this arrangement the occupants of the bed room would be disturbed by the presence of others in the bath room, who had waited till they themselves had retired.

These plans have been made as small as possible because of the limited amount of available space, in the average moderate cost house.

The addition of a foot or two would make them much more roomy, leaving the arrangement undisturbed.

Medicine Cupboard.

The medicine cupboard is usually built into the wall. Studs are set 16 inches on centers, thus leaving a space about 14 inches between them, into which the cupboard is set. Its size is therefore about 14 inches wide, 18 inches high and 4 inches deep, containing shelves to accommodate medicine bottles, etc.

The opening is closed up like the general house finish, except that the casings should not be over 3 inches wide. The door is set flush with the face of the casings and encloses a beveled plate mirror. The best location for the medicine cupboard is directly over the wash bowl with a light on either side.

The Bath Room Floor.

The floor may be of tile, composition flooring sometimes known as stone wood, or actual wood. Of these, tile is a good floor, but shows dirt, the composition can be made in any color, and therefore not as likely to look dirty and the wood can be of a kind that does not appear dirty unless it is badly neglected. Wood floors absorb moisture and are therefore unsanitary and require refinishing, an item that is constant.

Linoleum is a satisfactory floor covering in many respects, but hardly gives the appearance of quality necessary in a nice bath room. Dirt collects beneath and must be removed occasionally to keep the bath room in a sanitary condition.

A non-absorbent floor of a color that does not show dirt readily would seem to be best, but may interfere seriously with a bright, pleasant color scheme for the room.

If pipes are likely to need attention at any particular point in a tile or composition floor, it is well to put in a metal screw plate at once rather than to repair the floor after the plumber has chiseled through in several places to find the right one.

The Bath Room Walls.

A tile wainscot 4 feet high is very appropriate with a tile floor and should be finished with a neat tile cap.

A very nice effect may be obtained by the use of the tile marked oilcloths which are on the market, provided they are carefully hung and provided with a wood cap.

The plaster wainscot may be marked off to imitate tile and given a coat of enamel, in an inexpensive house both in bath room and kitchen. The wall above the wainscot cap should be hard finish for painting. A 3-inch "crown mould" placed at the ceiling and white enameled like the other finish will add much to the general appearance.

Plumbing Fixtures.

The Water Closet.

A water closet should possess a trap within itself, having a good seal, and with as little surface to come in contact with the soil as possible. The trap seal should be exposed to sight and the flushing should be noiseless and economical in the use of water and should come from a tank not directly connected to the water system.

The leading patterns of water closets in use are the washout, washdown, siphon and siphon-jet. Of these the two former are used in the cheaper work, and the latter in more important work and are best to use with a low down tank.

Local Ventilation.

A local vent spud, as it is called, is sometimes provided in the design of the water closet from which a vent pipe is run into a partition and from there into a hot vent flue. This carries off foul odors incident to the use of the closet. A small register face placed in the wall behind and at a level with the seat, connected by pipe to the flue, will effectively vent the whole room. Tin pipe, three inches in diameter, is often used and conducted into the main smoke flue high up in the chimney.

Flush Tanks.

High flush tanks have been in use for a long time and are reliable because of the "head" obtained by the water in the distance traveled.

The tank is usually placed in sight, but may be on the attic floor above or in an adjoining closet. The flush pipes may be in sight, concealed in the partition or through the wall in a clothes closet.

The low down tank, if placed in the room, sets the water closet further from the wall than with the high tank. Unlike the high tank, the low tank is closed at

top with a movable cover, keeping out all dust and dirt. Its position makes it easy to adjust or repair. The flush pipe should be two inches for this fixture.

Flush Valves.

Flush valves may be used on high or low pressure or direct or tank pressure, are noiseless and may easily be concealed. Provision is made for placing them in the floor if desired and their neat appearance has made them popular. Several different makes are on the market.

Wash Bowls.

Enameled cast iron and procelain lavatories are cast in one piece, including the back and bowl, thus avoiding all joints. Marble is no longer popular for plumbing goods, owing to the necessary joints, and its ready discoloration. Many patterns are available and may be supported on legs or on brackets in sight or concealed.

Bath Tubs.

Enameled cast iron bath tubs with wide roll rims are used more than any other. Porcelain tubs are used only in the very best work and enamel painted or copper-lined tubs not at all. The tub five feet long is most popular, although four feet six inches is allowable where space is restricted. Four-foot tubs are not comfortable and tubs exceeding five feet use a great deal of water if filled each time, an item to be considered with only a forty-gallon hot water tank, the usual size.

Foot Bath and Sitz Bath.

These fixtures are used only in the best residences and the piping in general is identical with that for the bath tub.

Shower Bath.

This fixture is set upon the floor and requires a 1½-inch connection.

House Trap.

This is a trap placed just inside the basement wall where the drain leaves the house with a fresh air inlet pipe from outside above grade, attached close to the trap on the house side of it. In cold climates the fresh air inlet freezes the trap and neither is allowed. All pipes and fittings should be securely fastened to wall or ceiling with iron anchors to properly support every joint.

Soil Pipe Stacks.

Where one or more water closets are drained the soil pipe should be extra heavy cast iron, coated, not less than four inches inside diameter. It should be continued of full size, twelve inches above the roof and there be encased in a galvanized iron frost-proof jacket with an air space of one inch around the pipe. The top of the jacket should be made of cast or wrought iron, containing a testing plug properly caulked to the soil or ventilation pipe, to be removed after test is over.

If the vent pipe is carried into a ventilation flue the jacket will not be required. No vent should open near a window or other opening that would allow the gas to penetrate to the interior of the house.

No trap is necessary at the foot of a vertical stack. No black wrought iron pipe or steel pipe should be used as soil, waste, ventilation or drain pipe.

Fittings.

All fittings for drainage should be recessed, drainage fittings presenting a smooth, continuous inner surface to the flow of drainage. Fittings for vent pipes may be the ordinary pattern of cast or malleable steam and water fittings.

Connections made in the run of soil or waste pipes should be made with "Y's" one-eighth or one-sixteenth

bends, or sanitary "Y-T's." Where it is impracticable to make offsets with the above fixtures, sanitary "T's" or one-fourth bends may be used.

Traps.

Traps should be provided with full-sized clean-out screws, plugs, covers or inlets which may be easily removed without damage to the pipe or disturbance of the ground or floor.

Lead traps and bends should be of not less weight than the grade known as "light" and of the drawn pattern. Lead pipes may be drawn of "extra light" weight.

Avoid traps having covers, hand-holes or clean-outs which are held in place by lugs or bolts, or have internal partitions or mechanical seals.

The depth of water in the seal of a trap should not be less than 1¼ inches and more in special cases. The trap should not be of less size than the waste pipe.

All traps, except anti-syphon traps, should be counter-vented from the sewer side of the trap.

Every sink, bath tub, lavatory, water closet, urinal, set of wash trays, or every fixture having a waste pipe should be separately and independently trapped with a water-sealing trap placed as near the fixture as practicable. Three wash trays set not more than six inches apart are considered as one set. All traps should be so placed that they can be readily cleaned.

Joints in Cast Iron Pipes.

Joints in cast iron pipes should be made with picked oakum, well forced into the joints with a caulking tool, after which molten lead is poured in and carefully caulked on its inner and outer circle.

Joints in Wrought Iron and Steel Pipes.

Joints in wrought iron and steel pipe should be made up with screw threads and all burns or cuttings on the inside of such pipes should be removed. The ends of pipes when used as waste pipes should be well reamed out before the joints are made up. All such pipes should be galvanized.

Joints in Brass and Copper Pipes.

Joints for brass or copper pipe should be made same as for wrought iron or steel pipes.

Joints in Lead Pipes.

Lead pipes on the sewer side of all fixture traps should be joined by wiped joints.

Joints Between Lead and Iron Pipes.

Connection of lead pipes with those of iron or steel should be made with brass ferrules, brass soldering nipples, or brass soldering unions with ground seats of a size not less than that of the lead pipe, with properly wiped joints and caulked or screwed into the iron pipe. But no slip-joints or washers should be used on vent connections.

Joints at Roof For Rainwater Pipes.

If rainwater conductors are placed on the inside of buildings, the joint connecting them with the roof of the building should be made with a brass ferrule and copper or lead connection.

Wastes.

Wastes should be of cast iron, galvanized wrought iron or steel, lead, brass or copper, and a fall of at least one-quarter inch per foot, greater wherever possible. The waste pipe from any other fixture should not connect to the house side, or in the seal of any trap.

Waste pipes from bath tubs or wash basins should not connect into the lead bend under a water closet, but in every case shall waste into the soil stack through a separate opening.

Refrigerator waste and overflow from tanks should not connect with any drain, soil, waste or ventilation pipe, but should discharge into an open fixture properly trapped.

Size of Waste Pipes.

A waste pipe 1¼ inches in inside diameter is sufficient for one bath tub, wash bowl, laundry tray, urinal or refrigerator.

A 1½-inch pipe will care for from one to three of these fixtures, and a 2-inch pipe from three to six.

A 1½-inch pipe is sufficient for from one to two kitchen sinks, and a 2-inch pipe will do for from one to twelve sinks.

A slop sink should have not less than a 2-inch waste pipe. A water closet requires a 4-inch waste or soil pipe, and in determining the size of stack in like proportion, four minor fixtures count as one water closet, and two slop sinks count as one water closet.

Back Vents.

The traps of all fixtures should have back vents connected to the crown of trap whenever possible and in no case more than one foot from the trap. Where a continuous waste and vent system is installed, the trap should be set as near the fixture as practicable and the horizontal distance from the fixture to the stack should not exceed two feet.

No horizontal run of vent should be used between the waste opening and the water line of any trap, where a continuous waste and vent system is used, but should have an up-grade of at least 45 degrees.

Back vents should be of cast iron, wrought iron or

steel, brass or copper, and lead pipes should be used only in making short connections between them.

Each vent pipe should have a trap screw soldered into it not more than six inches above where it connects with the trap, and this connection should also extend six inches above the water line of the fixture it serves before connecting with other vent pipes.

Where union joints are used on waste connections, no trap screw is required.

Vent pipes should be run as straight as possible with an up-grade to avoid trapping of condensation, and if finally connected to the soil pipe, this connection should be not less than one foot above the highest fixture. When such connection is made in the attic, it should be made at an angle of 45 degrees if the distance exceeds fifteen feet. If this angle cannot be obtained in the distance, the vent should continue out through the roof of at least two inches inside diameter and be furnished with a frost-proof jacket as before mentioned for soil pipe. This jacket will not be necessary if vent is conducted to a ventilating flue below the first floor with a "Y" and eighth bend. The main vent pipe should connect into the vertical stack.

Flush Pipes for Water Closets.

Flush pipes from open flush tanks should be at least 1¼ inches in diameter and those from low down flush tanks should be at least two inches.

Tests.

After all parts of the drain, waste and vent systems are installed and still uncovered they should be inspected and tested to see that all is perfectly tight and properly placed.

All the lead openings should be soldered up and all the iron pipe openings should be closed with screw plugs except the hand hole fitting at outside wall, where plaster-of-paris should be used. A suitable force pump

is used to produce an air pressure of five pounds per square inch and is registered upon the air gauge with a one-fourth-inch connection.

The fixtures are installed and the plumbing work completed after the plastering is done and the interior millwork in place. A final test is made equal to the pressure of one inch of water, after which the fixtures may be used.

Water Supply.

The water supply for the plumbing fixtures of a residence may come from the city mains or, if there is no provision of this kind, from some source from which it must be pumped—as well, cistern, stream or lake.

When taken from the water main in the street or alley, as the case may be, the connection is made of lead, tapping the main a little high, and the galvanized service pipe is so graded that any settlement will not bring it unusually low or break the connection. Lead being more pliable will stand a moderate amount of tension without breakage. At the curb a shut-off is placed for convenience in shutting off the water for any purpose. The ordinance usually provides that none but a licensed plumber or city employee may turn the water on or off at this point, and then only under proper regulations. As soon as the pipe enters the basement through the wall and before any connection is taken off, the water meter is installed with a plain stop on the house side and a check and waste on the street side. This fixture determines the amount of water used and should be set well above the floor and the waste so placed that a pail may be placed beneath to catch the water draining from the house system. Oftentimes the plumber sets this below the floor in a hole that is always damp and unsanitary, but it should not be allowed.

From the meter the pipe is carried to supply all the fixtures with both hot and cold water, except the water closet, which receives cold water only. A galvanized iron tank usually containing not less than forty gallons is used for hot water storage, tested to 200 pounds. The water is heated by coils in the kitchen range, tank heater or a coil in the firepot of heating boiler or furnace, or the most satisfactory way of heating water is with the instantaneous gas water heater; a small pivlet light is kept constantly burning and as soon as the faucet is turned the burner is adjusted and almost instantly the water becomes hot. The price of these varies according to size, but a medium sized one can be purchased for about $100.

The presence of a 40-gallon tank in a small kitchen is enough to heat it without other provision for this purpose, and when there is an excess of hot water as in the winter time with heating plant connection a pipe coil for radiation at some distant point may be supplied from the hot water tank.

If the hot water service pipe is taken off from the top of the tank the fixtures will be more readily supplied after the fire is started.

There should be a faucet near the tank for drainage, or at a point where it will be most effective, depending upon the location of tank and heating source. By the use of a circulation or return pipe, there will be less cold water in the pipe and consequently less waste of water. Air chambers are provided to prevent hammering in the pipes. They are commonly made by carrying the pipe from 15 to 20 inches above the cock or valve and this added length the air is compressed, making an elastic cushion which takes up the force of the blow. If there is a very heavy pressure the air may be gradually forced out of the chamber, being carried out with the water, and the chamber fail to accomplish its purpose. Pipes should be as

direct and simple as possible to avoid friction and unnecessary noise. Care should be taken to avoid cold exposures of the house, keeping the pipes to the center as much as possible.

Piping the House for Gas.

The main thing to look out for is to have the pipes large enough to supply all the lights, in case they should all be burning at one time. No pipe should be run smaller than three-eighths of an inch, and not over two lights should be supplied by this size pipe.

All pipes should be run so that condensation will run back into the main riser and down to the meter. Where pipes run across joist they should be run close to the bearings so as not to weaken them. All openings should be left at right angles with the wall and solidly fastened, so that there will be no possibility of displacing the pipe by screwing on the fixtures. Piping should also have an air pressure test of ten pounds to the inch, and if any defects are found, new fittings or pipes should be inserted.

Do not trust to wax to repair leaks, as it may necessitate disfiguring your walls or floors to get at the pipes later on.

Independent Water Supply Systems

IN the past ten years great improvements have been made in isolated water supply plants. Where formerly water was forced up, and distributed by gravity the pneumatic tank is now used almost universally. This system of air pressure has now reached a high degree of perfection.

One of the best of these systems consists of pneumatic tank, water gauge, pressure gauge, relief gauge, one pumping unit, one automatic starting and stopping device for motor, line switch, fuse blocks, pipe connections, fittings, valves and bases necessary to complete the outfit.

This apparatus consists of one or more large air-tight tanks and a pump to force water (sometimes air also) into the tank against the pressure of the air in the tank. The air being compressed seeks constantly to expand, thus keeping a constant pressure on the water in the water pipes of the house ready to discharge under pressure very similar to the water that comes from city water mains or a standpipe or elevated tank. The air pressure should be kept at the maximum, that is about all the air that the tank would hold if there was no water in it at all. This keeps up the pressure until practically all the water has been forced from the tank into the service pipes. That this may be done it is convenient to have an air gauge to determine the pressure and a water gauge to show how much water is in the tank, similar to the water gauge on a steam boiler. With these and the necessary valves for convenient operation, including a valve to turn either air or water into the

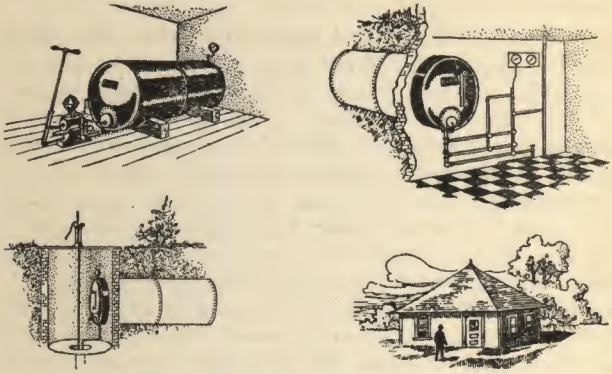
tank, as desired, any house with either well or cistern, or both, may be made to possess all the comforts of a modern, sanitary house. An average family of six persons in a house where water was supplied to kitchen, laundry and bathroom would require a tank of 300 gallons. Under ordinary pressure conditions about 217 gallons will be supplied before it is necessary to pump up again. This is over four barrels of water and would last the average family over two days.

If a greater capacity is needed it is better to install two or more tanks rather than get one of very large capacity. A large tank is hard to handle, expensive to ship, more difficult to set up and requires a larger opening to get it into the basement. If the single tank needs repairs, the whole plant is shut down, which is not the case when two or more tanks are used. A double-acting hand-operated force pump should be used, designed to pump either air or water and should have brass linings and brass valves. A pump may be operated by windmill, gasoline engine, hot air engine or electric power. The air pressure gauge in use is brass faced of the Bowden spring type and the water gauge is of glass with two brass gauge cocks and rubber adjusting gaskets. On the suction pipe should be 1½-inch brass check valve and a ¾-inch brass angle valve on the service pipe. A few minutes pumping should be enough each day with the hand force pump to keep the water supply full and the pressure sufficient to throw a stream over the house.

The pressure gauge may be located in the kitchen, if desired, where it can be observed. The tank may be placed in either the horizontal or vertical position, in the basement or under ground. It is not likely to freeze and a pressure of fifty pounds is equal to an elevation of 115 feet. Most towers for individual

plants are not over 40 feet, thus it is possible to maintain a much better pressure for protection against fire.

Gasoline engines are furnished with this system, of unusual economy, simplicity and freedom from trouble in operating. In these engines water is always available and a small stream circulating through the jacket keeps the temperature just right, protects the engine, deposits no scale, makes no steam, takes



(Fig. 29.)

no space, requires no watching. The water is perfectly clean and can be used for any purpose for which hot water is desired, or it may be wasted, as the amount is small and a few minutes pumping furnishes cooling for an hour's run. When the engine is used for other work, the cooling water is drawn from the tank. Drawing off the few pints of water in the jacket, gives absolute protection from freezing.

The following requirements constitute an ideal water supply:

First—It should not disfigure the landscape.

Second—It should not be exposed to extremes of temperature or the action of the elements.

Third—It should be so located that it will not be a menace to life and property in case of accident.

Fourth—It should be practically indestructible.

Fifth—It should be absolutely tight, so that no dust, disease germs, or other foreign substance can get into it.

Sixth—It should keep the water aerated, so that it will not become foul or stagnant.

Seventh—It should have sufficient storage and high enough pressure for fire protection.

Eighth—It should be compact, simple and easy to operate.

Heating and Ventilating

THERE is a great diversity of opinion as to the best and most effective method of heating and ventilating. Each system has suffered because of incompetent installation. The item of design, both of the building and the apparatus, should be considered in making a selection to get the best results. If there is a popular prejudice locally in favor of a certain system of heating, it is well to heed it if the house is ever likely to be offered for sale.

The Hot Air Furnace.

A compact house with rooms on two or more floors is easier to heat with a furnace than one requiring long horizontal runs of pipe to reach rooms spread out upon a large area.

The furnace is really a large stove enclosed in a galvanized iron casing, from which pipes are conducted to the rooms to be warmed and ventilated. Each room should have a return pipe back to the furnace to insure a proper circulation of air. Fresh air is taken in from a window on the exposed side of the house, or in some cases on two sides, by a galvanized iron duct connected at the base of the furnace. This is the method most in vogue at this time. The furnace is set directly upon the floor and the duct connected above it. Formerly, and it is still good practice, the duct was made of tile pipe with cemented joints, carried below the floor to a pit beneath the furnace. A slide is provided to regulate the amount of air admitted. The opening should not be located where dust or odors will reach it and should be protected with a coarse screen.

Return pipes should be located upon the cold outer

walls and it is usual to place the register face in position, connecting with the space between two studs, which forms the duct as far as the basement, at which point it is continued by pipes to the furnace.

In some furnaces these pipes are collected on either side and open into large water pans which precipitate all dust carried by the return pipe and supply moisture to the air constantly. Many people neglect to fill the pans and it is a good plan to pipe over to each pan from the hot water coil with a shut-off, making it an easy matter to keep them filled.

All pipes should run as direct as possible to the rooms they are to supply or vent and with as few sharp turns or angles as possible. The furnace and hot air pipes should be covered with asbestos and the joints of all vent pipes. Where the pipes enter partitions a very tight and careful joint should be made with the surrounding material to prevent gas from going up outside the pipe and escaping about the sides of the register face into the room. It is not likely that gas gets direct from the furnace into the heating pipes in a good furnace carefully installed, but very often it finds its way from the basement to the rooms above when the fire door is opened.

Smoke or gas is not supposed to puff out into the basement if the furnace is properly handled, but if it does a very satisfactory solution was made in a given case. A wide hood was built as low down over the fire door as was practicable and tapered up to a pipe with a damper. This was carried back over the furnace and joined the smoke pipe near the chimney. When the fuel was added the damper was opened and all gas and smoke passed up into the hood and to the chimney. On the same furnace was another hood near the floor, with a damper, under which the ash pail was set. This connected with the first pipe and carried off all the dust which arose, when ashes

were thrown into the pail from the shovel. Although there was a direct connection with the smoke pipe, neither of these pipes made any apparent difference in the draught.

Quite often furnaces are installed without the fresh air duct, but in such cases returns should be located near outside doors that fresh air may be admitted occasionally when a door is opened.

Oxygen is absolutely necessary to get the best results in heating and must be supplied in some way to the air in the house. Much is supplied by leakage about windows and doors, so that the interior system as it is called is often quite satisfactory.

The bath roon, kitchen, or a room occupied by an invalid should not be vented back to the furnace because the air from there would then be distributed over the whole house. Separate ventilation pipes should be constructed, connecting with a vent stack or with the main smoke flue near the top.

Chimneys are often built with a round tile smoke pipe contained in a rectangular brick flue, the space outside the pipe forming an excellent ventilating flue.

Register faces are best placed in the sidewalls because dust from sweeping does not so readily find its way into them and the heat is distributed quite as effectively.

Hot air cools quickly and the furnace needs more attention to keep the desired temperature. To offset this it responds quickly when the house gets cold which is a decided advantage.

Combination Hot Air and Hot Water.

This system provides a large coil above the fire from which pipes are run to the radiators. Short runs of furnace pipes do not act as well as longer upright pipes so it is well to place the hot water radiators upon the first floor and in rooms that are at a considerable dis-

tance from the furnace. The use to which a room is put should be considered also and in some both hot air and hot water may be used to advantage.

This would seem to be an ideal system on account of the opportunity for ventilation, the distance to which heat can be carried and the fact that hot water retains its heat so much longer that hot air alone.

The furnace should be located near the center of the space occupied by the registers and a little nearer the side from which the winds come in winter time.

Steam Heat.

Less radiation is required for steam heating than for hot water heating and effects quite a saving in the comparative cost.

The water must be brought to the boiling point before the system become effective and the steam condenses very rapidly if the fire is not kept at, leaving the house cold.

The radiators are much hotter than for hot water and this effect upon the air is not desirable.

Explosions of gravity heating plants are quite rare, being caused by only gross carelessness.

Each plant should have an indirect radiator supplied with fresh air from outside discharging it into the front hall or other effective place where it will be generally circulated.

Steam heat is said to give specially good results in the coldest weather and uses no more fuel than a hot water plant, but in moderate weather will use more to keep up steam. Economy of fuel is a matter largely in the hands of the operator of the plant.

Hot Water Heating.

No system is quite so popular at the present time as hot water heat for residences. The open-tank system is mostly used and, with no valve on the expan-

sion tank, cannot possibly explode unless the expansion pipe freezes, which is not likely.

The radiators contain more sections than for a steam plant but the pattern is the same. The hot water being much cooler than steam, the air coming in contact with the radiator is tempered without taking all the life-giving elements out of it.

The heat can be controlled by the fire or by the valves on the radiators and the radiators will give off heat when the water in the boiler reaches a temperature of 100°. This means that only coal enough is required to bring the water up to 100°, while with steam heat, enough must be consumed to reach 212°, the boiling point, before it will begin to give off heat. While the water may become much hotter than 100° yet it is evident that there is a saving in coal.

Hot water remains hot for hours after the fire has gone out, depending upon the temperature outside. In like manner it does not get hot as quickly as hot air or steam.

It is perfectly noiseless, there being no snapping or gurgling noises.

In the installation of either steam or hot water care should be taken to have the pipes of proper size, properly graded and run in the most direct manner.

Pipe covering of good quality will effect quite a saving in fuel. Radiators should be set where the exposure is greatest.

Two small radiators set at advantageous positions in a room will be more effective than one large one.

Special patterns in radiators are provided to go flat upon walls or ceilings where economy of space is required as in bath room, etc.

Indirect radiation should be provided for the hot water plant as in the steam plant.

Heat Regulators.

Each heating plant, either furnace, steam or hot water should be provided with a good thermostat.

This is a device consisting of a thermometer, a motor and batteries. The thermometer is set in the living room, or any desired position and an indicator is set at the temperature most satisfactory, usually 70°. If the mercury goes below 70° the battery releases the motor in the basement and it regulates the draughts automatically. As soon as the mercury again reaches 70° the motor reverses the position of the drafts preventing the fire from raising the temperature above this point. So delicately are they constructed that, when properly adjusted, a single breath from the body will cause the motor to act, only to re-act a moment later when the effect has passed away.

Day and night the regulator will hold the temperature at the degree set, provided the fire is well kept. A clock attachment may be provided that will turn the indicator higher at any hour set, if it is desired to maintain a lower temperature during the night, or at any time.

The motor must be wound up and occasionally new batteries are required at an outlay of 50 cents, otherwise repairs are very few in a good instrument. Where there are small children to consider or it is desired to keep an even temperature without further trouble, a heat regulator will be of the greatest service.

Specifications.

No specifications are outlined for any of the systems enumerated because it would be impossible to give exact instructions to fit all conditions and makes of apparatus.

It is usual for heating contractors to submit specifications with their bids, which should go quite fully into detail.

In any system the size of the fire pot should be considered and the general size of the furnace or boiler.

With a sectional house boiler, no good idea of its size can be obtained from the size of the fire pot, because a section may be taken from the boiler or added to it.

The size of the mains is important and the location and size of the radiators. See how much radiation is figured by each contractor in the aggregate, also if the radiators are of standard height. Sizes other than standard cost more, but in some positions will be more satisfactory. Note the kind of valves to be used and any special features mentioned.

By a comparison of all the bids a good idea may be obtained of their relative value, other than the sum total in dollars and cents.

See that the accepted bid guarantees to perform the work in accordance with the specifications and that the plant will be of ample capacity to maintain a temperature of 70° in the rooms heated, when the temperature outside is at the lowest point that is usually reached in your locality. It is not uncommon to state this at 40° below zero, in our most northern states.

Hot water for the plumbing fixtures is supplied by a coil in the firepot. Have a definite understanding as to who is to furnish and install the coil, the plumber or the heating contractor.

Employ a reliable man, handling a boiler or furnace of established reputation, and who knows his business.

Vacuum Cleaning

THE time is fast approaching when no house of ordinarily good construction will be considered complete without some system of vacuum cleaning. If the plant cannot be installed at the time the house is built, provision should be made for it by the introduction of the necessary pipe with outlets at each floor. The expense will be nominal and will avoid difficulty when the system is finally installed.

The apparatus consists of an electric motor, a vacuum producer, an oil separator, a dust separator, dust receptacle, suction main, necessary connections, the hose and cleaning tools.

The system is under perfect control of the operator at all times and the number and variety of cleaning devices, make it possible to remove dust and dirt from any position. Special brushes are provided for floors and walls, some with bristles sufficiently stiff to scape off the dirt which is sucked up by the hose before it can fall. Carpets and upholstery or bedding are provided for with specially designed tools which not only remove the dust and dirt to the best advantage but also odors.

A special pipe carries odors from the system and is connected with the chimney, thus discharging them from the house.

This is a carefully constructed permanent system of the best type. The contents of the dust receptacle are removed in the basement and burned or carried off.

If a machine of the above type is too expensive there are portable devices available which will give excellent service within their capacity. There is, of course, no ventilation pipe and apparatus must be carried from

room to room. Some are operated by electricity and others by hand power.

It is hardly necessary to disturb the contents of a room at all in using a vacuum cleaner and if power is supplied no special labor is required to operate it. The work is quickly done and additional help for the purpose is not necessary. The employment of an extra person one day each week at present rate of wages, would soon make quite a sum towards the purchase of a machine.

The Use and Abuse of Vacuum Hose.

Much has been said as to the use and abuse of the vacuum hose used in connection with an Air Cleaning System. This particular part of the installation receives the hardest wear and tear. At the same time it is the weakest, and the most expensive part of the installation.

In order to reduce the amount of vacuum hose necessary, the pipe system should be more extensive; that is, provided with a greater number of risers and inlets throughout the building than has been the custom in specifications of the past.

Architects and engineers should specify a piping system consisting of a sufficient number of risers and inlets, so that the system will not require the use of more than 50 feet of vacuum hose in public buildings and 25 feet in residences; thus giving better service at less cost of maintenance.

The Conductor.

The main part of the conductor of a Stationary Vacuum Cleaning System is the pipe. This should be of wrought iron, with a smooth interior free from all fins or burrs, with long-turn, recessed type drainage fittings. The pipe should be of adequate size, so that the vacuum loss will not be excessive, with the use of a vesocity not

less than 2,500 feet per minutes, and should allow the free passage of match sticks, cigar stubs, etc. The pipe inlets should be not less than two inches in diameter to allow the use of any standard diameter of vacuum hose.

The vacuum hose should be constructed of light, flexible material, reinforced with spring steel wire. The hose should also be of ample size to allow the free passage of such coarse articles as are spoken of in the preceding paragraph, and to prevent an excessive loss of vacuum due to the passage of the large volume of air necessary at the tool for effective cleaning.

The tool used for cleaning has been neglected by many manufacturers. It is, however, a very important part of the conductor. The tool should be so designed as to be operated with ease and rapidity, and constructed along such lines as to make it adaptable to the particular surface to be cleaned, as well as durable and easily renewable.

The equipment will generally consist of a large variety of tools, designed and constructed for special uses. The carpet and hardwood floor tools are always given the most attention, because of their frequent use and severe service. The carpet tool should be of light material, such as aluminum or its equal, with a shoe of some hard substance, such as steel or phosphor bronze for rubbing surface. This will resist wear and will not become sharp and rough; thus the fabric being cleaned will be saved from injury. The hardwood floor tool should be constructed on the same principle as the carpet tool.

A Final Word

THE design having been settled upon, the character and method of construction to be used, the various features and conveniences that are to be incorporated in the house having been fully set forth by the plans, details and specifications as prepared by the architect, and the various bids having been received, the question of letting the contract becomes a final matter of the most importance.

There are a great many things to be considered at this time. In the first place, nothing is gained in having a man bid upon the work, who is not reliable in every respect. In this, however, honesty and mechanical ability is more important than financial responsibility, though the latter phase of the matter must certainly be looked after. If, however, a builder or contractor be thoroughly versed in the different trades represented by the work for which he proposes to contract, as he should be, he ought to know what the work is worth and will not put in a figure for less than it will cost him. If he be this kind of a man and be awarded the contract, he will do the work to the best advantage possible. That is, he will not let his profit, and more too, perhaps, slip through his fingers by making errors in ordering his materials, by lack of attention to the work, this causing expensive delay, in not having the materials on hand for use when they are needed, in hiring poor and incompetent assistants, in having too many men at certain stages of the work when he cannot use them to advantage, in having enough men on the job when there is opportunity to use a large force to good advantage, in being fully posted as to where to buy the best materials for the least money, and possessing a thorough general knowledge such as will

enable him to lay out his work in an intelligent manner, so that it can be performed rapidly, too good advantage and without its being necessary to do any work over by reason of errors or an inability to "read" plans.

A bond is sometimes furnished by the contractor and is a pretty good thing to have with whom you are dealing. If the bond is a surety company bond, and after all, perhaps, this is the most satisfactory sort of a bond to require, the scurety companies are not very liable to pay a claim accept under pressure.. If a surety bond be furnished by the contractor who obtains it has not propery which can be used as a guarantee, the surety company will require personal bondsmen, which might as well be furnished direct to the owner as though a surety company enabling him to save the fee. A surety company would, however, probably make good a claim quicker than personal bondsmen.

It is impossible to lay down specific rules for guidance in these cases. The character of the man with whom you are dealing is of prime importance. In the first place, be sure you get a competent and, by all means, an honest, man, who understands his business. In the second place, look out for the financial part of it and protect yourself against possible loss.

One thing which should not be forgotten is the insurance on the building during its construction. This is generally most satisfactorily arranged by the owner placing a permanent policy on the building, obtaining from the insurance company a sixty-day clause, allowing him to complete the building within that time. This makes the cost of the insurance considerably less than if the contractor is compelled to place a short time policy.

Explanation of Terms

Abutment—That which borders on another as a bottom or support. A pier or wall which receives the thrust of an arch.

Balusters—Small spindles or columns usually forming the body part of a railing.

Base—Baseboard—a Board running around a room next to the floor to properly finish between floor and plaster.

Bed and *Bond*—Bed, meaning the way in which a stone rests in the wall. Bond, meaning the stone crossing through the wall so as to tie together both faces of same in a bond.

Bench—A ledge of earth, stone or brick work usually left to receive a brick or stone arch.

Broken Ashlar—A form of stone work apparently irregular, but in fact strictly regular when correctly laid.

Buckling—Bending.

Capitals—Top of a column, pillar or pilaster serving as the head or crowning.

Conduit—A channel that conveys water or fluids, a drain or sewer. In electric work, for carrying wires as a protection and for safety.

Corner Board—Upright board placed upon the corners of a house to give a pilaster effect or to avoid the mitering of siding on the corners.

Cornice—The upper division of the entablature of a column; the highest projecture; that which crowns a wall.

Dadoed—Mortised into.

Decks—Flat roofs, usually tinned over.

Dentil—An ornament bearing some resemblance to teeth.

Dove-Tailed—Letting one piece of wood into another to form a wedge reversed so it cannot be drawn out, though pins may be used for this purpose instead.

Flashing—Pieces of lead or other metal let into the joints of a wall so as to lap over the gutters and prevent leaks.

Footing—The broad foundations of a wall, pier, post or chimney.

Forms—In concrete work, temporary wood boxes, floors or partitions, to contain or hold concrete until set.

Furring—Nailing on thin strips of board to level a surface for lathing, boarding, etc.

Gain—Cutting the joist to receive a timber, or cutting the joist to notch on top of the girder.

Girder—The principal supporting piece of timber in a floor.

Grounds—Pieces of wood flush with the plastering for nailing purposes.

Grouting—A filling of coarse mortar or concrete.

Hand-Hole—A large opening in a pipe for clean-out purposes.

Haunches—The low point where two arches come together or where an arch butts against a wall.

Headers—A timber or double joist placed across an opening in a floor to receive and support other joist.

Hips—The exterior corners of a roof where two slopes, at right angles with each other, come together.

Horses—Notched plank to receive the treads and risers of a stair.

House—Space taken out of one solid to admit the insertion of another, as in housing the treads of a stair into a string; mortising into.

Indirects—A heating term meaning a room heated indirectly by bringing fresh air into it, first passing it over a coil of pipes to be heated, just before it enters the room.

Jack-Rafters—Short outlookers or false rafters.

Jamb—Side piece of a door or window.

Joist—Timbers used for supporting a floor.

Lintel—Horizontal piece over a door or window opening, of any material, used for appearance or support of wall over, or both.

Lipped—In connection with drawers, the lip projecting all around the drawer, making it larger than the opening so that the drawer cannot slip through.

Miter—To join two pieces at an angle.

Modillions—An ornament of a cornice, or kind of bracket to support a projecture.

Muntins—Small divisions separating panes of glass in a window. They are more properly called sash bars.

Newels—The upright posts or cylinder at the start of the stairway usually receiving the stair rail. On landings and top of staircase for the same purpose.

Out of Wind—In line with each other; straight; level.

Perch—Of stone, is considered in this book as being sixteen and one-half cubic feet.

Plate—A piece of timber on top of a wall giving support and bearing to the ends of rafters.

Plinth—The block that receives the casings and base of a door opening.

Puddling—Moistening, to prepare firm and even foundations.

Rabbeted—Grooved, to lap and unite the edges of; as boards.

Rail—The horizontal board in any piece of framing or paneling.

Ribbon—The term usualy applied to a small strip notched into the studding to support the second floor joist.

Ridge—Raised line or strip on the peak of a roof.

Ridgeboard—The board or ribbon to receive the rafters under or forming the ridge.

Riser—The upright portion of a step.

Rodded—Making level and even with a rod or straight edge, as in plastering.

Roof Pitch—The proportion obtained by dividing the span by the height. Thus we speak of one-half, one-third and one-fourth pitch.

Rock Face—A surface on stone produced by chipping it.

Rubble—The term applied to ordinary stone work, rubble meaning that stones are indiscriminately used without regard to size or shape, if they have a natural bed and are of reasonable size.

Saddleback—A hip or A to go on the roof behind the chimney, throwing the water around the same.

Shoe—The lowest member of a baseboard making the finish against floor.

Sills—The lowest member in the walls of any structure.

Spalls—Small pieces of stone or brick-bats used for filling the smaller spaces of the wall.

Square—One hundred square feet.

Stile—The upright piece in framing or paneling.

Strings—String-Board—A board or plank with its face next the well-hole; to receive the ends of the steps.

Studs—Upright scantlings.

Tamping—Pounding down material, as sand or concrete, to its hardest bed with a wood or iron object of at least twenty (20 lbs.) pounds weight.

Tees—Fittings in the shape of a "T" to receive pipes going in opposite directions and at right angles.

Thimble—A rim to receive a pipe, used in connection with a stove pipe in a chimney.

Tooth-Chiseled—A surface on stone obtained by cutting parallel furrows in it with a tooth-like stone chisel.

Tread—The flat portion of a step.

Trimmers—Double or triple joists or timbers for framing an opening in the floor. Support for "headers."

Troweled—Leveled off with a trowel.

Valley—The inside meeting point of roofs sloping at right angles with each other.

Wainscot—To line with boards or panels.